FINAL REPORT

CHALLENGE 2000

RECOMMENDATIONS FOR FUTURE AVIATION SAFETY REGULATION

Shifting Roles and Responsibilities Between FAA and Industry

Prepared for

FEDERAL AVIATION ADMINISTRATION

OFFICE OF POLICY, PLANNING AND INTERNATIONAL AVIATION

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EXECUTIVE SUMMARY

Within the aviation industry, the entire range of activities in aircraft manufacturing and maintenance and in airline operation, ownership and services is becoming increasingly complex. Major structural changes and operating efficiencies are being brought about by rapidly developing technologies, the globalization of aircraft design and production, airline consolidation and changing patterns of world trade. These developments will continue at a steady pace, while Federal government resources are being constrained by the need to reduce deficit spending. These increasing fiscal pressures are placing strains upon FAA regulators to keep pace.

The Office of Regulation and Certification (AVR) is responsible for implementing that portion of the FAA Charter that covers aviation safety regulation, and performs three primary activities to this end: certification of aircraft, development of flight operations standards and procedures, and management of the rulemaking process. AVR's responsibilities are central to all missions of the FAA, and as such, impact every aspect of the civil aviation industry. AVR has authored much of the aviation regulatory system that exists today. The regulatory system has slowly but relentlessly evolved, becoming both complex and, in part, antiquated. The current body of U.S. airline operating standards were written in an era when airlines were subject to regulation by the Federal government.

Arising from a major aviation safety conference in 1995, one safety initiative recommended was a comprehensive review of all industry oversight procedures and programs. The FAA Administrator established the "*Challenge 2000*" Project with several objectives, including:

- Finding an operational paradigm by which AVR can assist the industry to move toward zero accidents
- Developing the necessary processes by which AVR can "do more with less".

Booz·Allen & Hamilton has analyzed the future aviation safety regulatory environment, and working closely with the FAA's Challenge 2000 Senior Executive Panel, with AVR and with the Administrator, has developed a change program designed to reposition AVR for anticipated changes in the environment it regulates. These recommendations call for sweeping changes in AVR's regulatory philosophy and approach, its organization, the deployment of its resources, and its mix of skills. But this must be done within expected resources, with the intended consequence of improving aviation safety nationally and internationally. The four elements of the change program, which are an integrated set of mutually supporting recommendations, include:

1. **Shifting roles and responsibilities of AVR and industry.** AVR will move to program level definition, design, and insertion of industry safety programs. AVR recognizes that some of the air carrier and manufacturing organizations it oversees presently exceed "minimum standards" as defined in the Federal Aviation Regulations, and through proven safety records, are capable of a greater degree of self-regulation. Only by devoting fewer resources to the oversight of these organizations will AVR be able to shift its resources to other, generally smaller organizations that require more intensive oversight and direction. Consistent with this observation, the Challenge 2000 Project recommends a

reallocation of the roles and responsibilities between AVR and certain segments of the industry it regulates.

2. **Deploying functional resources through "Centers of Excellence".** AVR's current mix and deployment of skills reflects the needs of the aviation industry as it existed when AVR was formed. The air carrier industry is becoming more sophisticated in its operations, and is in the midst of globalization. Evolution in aircraft technologies such as structures and materials has slowed, while computer hardware and information technologies to include state-of-the-art multi-national satellite CNS/ATM systems are now rapidly evolving. The Challenge 2000 Project recommends a broad overhaul of the structure and technological capabilities that reside in AVR through the adoption of "Centers of Excellence" (CoEs) as AVR's new delivery mechanism, each employing a substantial number of industry safety experts and National Resource Specialists. Detailed recommendations include the establishment of a new aviation information technology CoE, and an international safety regulatory CoE.

3. **Empowering rulemaking and evolving to performance-based regulations.** The current system of FARs and procedural handbooks is inflexible and inefficient, and not well positioned for the future environment. The rulemaking process takes too long and discourages widespread industry involvement. The Challenge 2000 Project recommends that these problems be addressed by redesigning the rulemaking process, employing and integrating the focused capabilities of the new Centers of Excellence, and by moving to performance-based regulations wherever appropriate.

4. **Resizing and restructuring AVR for the new mission and operating model.** The changes in roles and the needed delivery mechanism of AVR require a general reengineering of the organization and its processes. This reengineering will also allow AVR to institute improved work force skills and processes throughout the organization, and to utilize information and automation technology to increase efficiency and industry safety. The Challenge 2000 Project recommends that a comprehensive process reengineering program be implemented, and that regulations governing these processes be revised to fit the new mission and operating model.

A financial analysis has indicated that it is possible for AVR to complete the change program over a period of 3 years, using natural attrition of its work force and an aggressive restaffing program as the primary means of cost recovery. Under a declining budget scenario of 20 percent over a 5 year period, the completion of the change program is likely to be delayed by 2 additional years.

Much of the work of the Challenge 2000 Project lies ahead. Implementation will require creativity, ingenuity, courage, and the power to persuade and motivate all who are touched by the coming changes — both internal and external to AVR.

1 THE REQUIREMENT FOR THE CHALLENGE 2000 PROJECT

The aviation industry is evolving in new and compelling ways. Major structural changes and resulting efficiencies are being brought about by increasing technological developments, the globalization of aircraft design and production, airline industry consolidation and changing patterns of world trade. The entire range of activities in aircraft manufacturing and maintenance, and in airline operation, ownership and services is becoming increasingly complex.

1-1 A Changing Aviation Environment

Today, the aircraft manufacturing sector is in the midst of globalization, even those portions still centered in the US. The older Boeing 727 and the McDonnell Douglas DC-10 were almost entirely produced in the U.S., while as much as 30 percent of the value of new U.S. aircraft such as the Boeing 777 and the MD-11 is contributed by manufacturers in Europe, China, Korea and Japan. It is anticipated that China will be responsible for fabricating tooling and manufacturing parts for up to 70% of the McDonnell Douglas MD-90 airframe content. The United States represents the world's largest market for aircraft having 50 seats, yet none have been designed or produced here since the 1970's.

New aircraft now rely upon sophisticated systems that transcend the historic division of aircraft structures, power plants and avionics. Modern engines such as the GE90, Trent, and the Pratt & Whitney P4084 include extremely sophisticated avionics designed to monitor fuel economy and fine-tune in-flight performance. All the while, new satellite communication, navigation and surveillance systems are being developed, promising unprecedented economic benefits to air carriers. New certification requirements raised by added ground-air system complexities thus challenge the traditional partitioning of aircraft, ATC systems and flight operations.

The air carriers, not immune to change themselves, are seeking ways to become more profitable in light of deregulation's lasting effects. Traditional international boundaries are becoming blurred in light of "Open Skies" agreements and liberalized bilaterals. U.S. carriers, anxious to access new, high growth regions of the world without incurring significant market entry costs are reverting to marketing arrangements and "code sharing" to accomplish this. Consolidation has led to mega-carriers with more than 300 aircraft, a sight now common throughout the world.

Shifting regional trade patterns and demographics are also transforming the aviation environment. International commerce and growing regional affluence in Asia and South America translate into air travel that will grow by 50 percent in the coming decade. At the same time, society has experienced a dramatic increase in substance abuse and in threats of international and domestic terrorism with potential effects on aviation safety for Americans and others traveling abroad.

Through all this, the industry has become more sophisticated, and remarkably, has improved both the safety of flight and the efficiencies under which it must operate. Quality standards are significantly improved, owing partly

to widespread popularity of advanced process control systems and total quality management programs. Better employee skills and cooperation with management are also gaining recognition for their contribution to this success.

But the full safety and efficiency benefits of new aircraft or airline operating procedures are often not realized because civil aviation agencies are not furnished with resources required to match the new capabilities of the private sector they regulate, nor with modern air traffic control systems and automated procedures. World civil aviation agencies are being challenged to modernize their regulatory and safety processes and air traffic systems. This urgency comes from economically driven airlines and manufacturers, development banks and importantly, taxpayers.

Increasing fiscal constraints are placing strains upon the regulators to keep pace. Change is occurring and will continue at a rapid pace while Federal government resources are being constrained by a need to reduce deficit spending. The chorus increasingly heard is for government to "do more with less."

1-2 Aviation Safety and Challenge 2000

The public perception of aviation safety is more informed today than at any time since the passage of the Air Commerce Act of 1926. The future of the aviation system is uniquely dependent on the public's continued faith in its safety and integrity. A safe aviation system is thus the primary goal of industry and government.

A spate of airline accidents in the United States and abroad gave rise in 1995 to renewed efforts by the U.S. Department of Transportation (DOT) and the Federal Aviation Administration (FAA) to perform a searching and thorough self-evaluation of the state of airline safety. At a recent aviation safety conference, Mr. David Hinson, the FAA Administrator, said "We can achieve zero accidents. We must achieve zero accidents." From this conference, four principles were adopted by industry and Government to guide the development and implementation of future aviation safety initiatives:

- Pursuing the goal of zero accidents, a shared responsibility of all Government, industry, and labor organizations, and of each individual member of the aviation community;
- Changing the mindset of the aviation community from one that minimizes accidents to one that demands zero accidents;
- Adopting proactive FAA and industry approaches to safety with a focus on anticipating safety threats and preventing mishaps; and
- Freely sharing safety data and information among members of the aviation community to ensure the greatest safety benefits to the flying public.

The key element of the Transportation Secretary's safety initiative was a comprehensive review of all industry oversight procedures and programs. The FAA Administrator responded by establishing a "*Challenge 2000*"

Team. Challenge 2000 focuses on current and future issues that will make significant changes within the FAA and its regulatory processes both essential and urgent.

1-3 Goals Of The Challenge 2000 Project

The Federal Aviation Act of 1958 established the FAA to promote the safety of civil aviation and to foster development of civil aeronautics and air commerce. Part of the FAA's basic responsibilities includes the regulation of air commerce and the development of safety standards for design, manufacture, operation, and maintenance of civil aircraft products. The Office of Regulation and Certification (AVR) is responsible for implementing this portion of the FAA Charter, and performs three primary activities to this end: aircraft certification, development of flight operations standards and procedures, and rule making. AVR's responsibilities are central to all missions of the FAA, and as such, impact every aspect of the civil aviation industry.

AVR has authored much of the aviation regulatory system that exists today. The regulatory system has slowly but relentlessly evolved, becoming both complex, and in part antiquated. For example, modern aircraft regulations are based upon a manual which was written when aircraft were still propeller driven and operated almost entirely within the boundaries of a single country. The current body of U.S. airline operating standards were written in an era when airlines were subject to regulation by the Federal government. While many rules have been rewritten since 1978, the year of deregulation in the U.S., the Federal Aviation Regulations (FARs) still contain procedures involving the use of outdated technologies.

Referring to the rate of change in the aviation environment, FAA Associate Administrator for Regulation and Certification, Anthony J. Broderick, recently stated that "with the exception of the first 17 years, more change has happened in the last 17 years of aviation than at any other time." The pace of this change and of industry growth pose significant challenges for the FAA in the areas of accommodating technology change, maintaining international leadership, and managing shrinking resources. Despite this, the average time to produce a new rule, even one of important economic or safety consequence, is three to four years or more.

Under these circumstances, it is imperative that FAA assess its readiness to cope with the rapidly changing and increasingly challenging environment in which it will be required to perform its safety regulation mission, and determine the appropriate type, quantity and deployment of human and other resources needed by AVR to assure aviation safety in the 21st century. This program of assessment and resource requirements analysis has been called The Challenge 2000 Project.

On one level, the Challenge 2000 Project can be characterized simply as a study of current and expected future challenges to FAA regulation of aviation safety, with the objective of identifying options for the FAA to provide essential future safety and enforcement services with expected levels of resources. However, this statement of the objectives of the project does not communicate the complex nature of the FAA's future safety regulatory mission. Consider for a moment the following goals which underlie the project objectives:

- Finding an operational paradigm by which AVR can assist the industry to move toward zero accidents; and

- Developing the necessary processes by which AVR can "do more with less."

These goals make clear why the name "Challenge 2000" is truly justified as a descriptor for this ambitious project. The Challenge 2000 initiative was established to review and improve current processes, and to identify redundant and low value practices, as well as those safety regulatory functions which could be significantly enhanced by organizational change. Personnel qualification standards need review to ensure the proper mix of skills, capabilities, and experience moving into the next century.

Aviation safety must be held at existing or improved levels all the while Challenge 2000 is being implemented by the FAA. Cultural and attitudinal changes will be required of AVR and industry to make it successful, and with the added complexity of the very regulatory processes which must be improved, Challenge 2000 will be implemented over a period of several years. However, the impact of many of the recommendations found herein will have an immediate beneficial impact.

1-4 An Overview Of The Challenge 2000 Methodology

Booz·Allen & Hamilton Inc. was asked to conduct a study of the current and expected future challenges to the FAA's regulatory and certification regime, principally those pertaining to the Office of Regulation and Certification. This included:

- Analyzing the factors which characterize and affect the current and future (next 20 years) aviation safety regulatory environment, including changing organizational practices of the manufacturing sector, commercial air carriers, commuters, air taxis and general aviation; personnel recruitment and training; aviation security threats; provision of infrastructure; international political and economic matters;

- Establishing a baseline for AVR, including current statutory requirements, regulatory environment, practices and processes, work force and organization;

- Examining alternative approaches to safety regulation employed in other countries with large aviation manufacturing and air carrier operations, as well as other risk adverse industries in the U.S., such as nuclear power regulation;

- Identifying potential needed changes in the current regulatory practices of AVR, including certification and enforcement, and an in-depth examination of industry roles, and responsibilities that would sustain or improve aviation safety while maintaining or reducing expenditure of FAA resources;

- Examining expected costs and benefits to FAA and industry of these needed changes; and

- Preparing an implementation plan and specific actions and milestones by which the organization could measure progress in change.

To accomplish this work in the short time available, three teams were organized, each having separate but interactive functions and responsibilities to meet the goals of Challenge 2000:

- FAA Senior Executive Panel, comprising senior FAA managers and chaired by the Assistant Administrator for Aviation Policy and International Affairs, Barry Valentine;

- Research and Development Advisory Committee, chaired by James Abrahamson, Lt. Gen. U.S. Air Force (Ret.), tasked with examining the impact of new technologies upon aviation safety regulation; and

- Booz·Allen & Hamilton, Inc., employing its own integrated team of business management and aviation industry professionals to analyze the FAA's regulatory mission through critical issues analysis and research.

In response to this tasking, this report summarizes the work of Booz·Allen, and presents the basic elements of a comprehensive change program for the FAA to provide essential future safety regulation and enforcement services within expected levels of resources.

1-5 External and Internal Contributors to Challenge 2000

To determine the factors which characterize and affect the current and future aviation safety regulatory environment, several primary and secondary sources were sought. Table 1-1 lists the external organizations that shared their views with Booz·Allen in support of the Challenge 2000 Project.

The FAA published a notice in the Federal Register on November 2, 1995, seeking public comment on regulation and safety as it related to the Challenge 2000 Project. For example, stakeholders were asked to comment on: whether or not they believed that the FAA's regulation, certification, and enforcement functions currently provide an adequate level of safety oversight; additional safety oversight services that FAA should be providing; and the relevance and currency of the FAA's regulatory and certification processes in light of technological advances. Respondents were also invited to provide insight into the future aviation environment, and comment on what changes were needed in the FAA's regulatory and certification processes to meet the challenges of the future. Over 20 responses were received from various aviation stakeholders, including manufacturers, trade associations and airports. The most relevant responses were reviewed and have been considered herein. Finally, several organizations saw fit to canvas their members on the Challenge 2000 Project, including AOPA and the International Airline Passengers Association (IAPA). These responses have been incorporated into this report as appropriate.

Within the FAA, Booz·Allen held discussions with over 150 senior managers and staff at headquarters in Washington, DC, and in AVR's regional and field offices. Extensive discussions were held over a period of six months with the Office of Regulation and Certification, most of its directors, its managers, inspectors, engineering

and designee work force. The FAA Administrator, Deputy Administrator, and many of the Associate and Assistant Administrators contributed to the findings contained herein. Booz·Allen held working sessions with the FAA Challenge 2000 Senior Advisory Panel on eight different occasions, and briefed the FAA Management Board twice.

Airlines	Manufacturers	Associations	Government/Other
Air Canada	Airbus Industrie	Aerospace Industries of America (AIA)	Airways Corporation of New Zealand
Air Wisconsin	AlliedSignal Aerospace	Airline Pilots Association (ALPA)	Australian Civil Aviation Authority
American Airlines	Allison Engines	Airline Owners and Pilots Association (AOPA)	Civil Aviation Administration of the United Kingdom
Atlantic Southeast Airlines	Boeing Aircraft	Aeronautical Repair Station Association (ARSA)	Congressional Transportation Subcommittee
British Airways	Boeing Helicopters	Air Transport Association (ATA)	DOT Office of Chief Counsel
Continental Airlines	Cessna	Experimental Aircraft Association (EAA)	Enterprise Systems
Continental Express	Daimler Benz Aerospace	Flight Safety Foundation (FSF)	Food and Drug Administration
Delta Airlines	Embraer	General Aviation Manufacturers Association (GAMA)	Georgia Tech Aviation Research Institute
EastWind Airlines	GE Aircraft Engines	National Business Aircraft Association (NBAA)	Internal Revenue Service
Mesaba	McDonnell Douglas	Small Aircraft Manufacturers Association (SAMA)	International Civil Aviation Organization
Northwest Airlines	New Piper Aircraft		National Aerospace and Aeronautics Administration
Southwest Airlines	Pratt & Whitney		National Transportation Safety Board
United Airlines	Raytheon Business Jets		Nuclear Regulatory Commission
United Express			Occupational Safety & Health Administration
USAir			Transport Canada
Varig			
Westair			

TABLE 1-1 CHALLENGE 2000 EXTERNAL PROGRAM CONTRIBUTORS

2 THE CURRENT REGULATORY FRAMEWORK

The FAA's Office of Certification and Regulation operates within a complex regulatory framework designed to promote aviation safety. AVR and industry together have built and demonstrated one of the safest aviation systems in the world. To better understand the regulatory roles and responsibilities of AVR and industry that have contributed to this record, a baseline of the current regulatory framework was assembled. This baseline was used to fashion the Challenge 2000 change program, with its goal of improving the performance of AVR and the system it regulates within expected fiscal resources.

2-1 The Aviation Safety Environment

The FAA's fundamental role, as embodied in the Federal Aviation Act of 1958, is to ensure a safe flying system. The success of the FAA in fulfilling this requirement is best demonstrated by the aviation safety record, which continues to be the benchmark for the rest of the world. An examination of the safety environment shows a steady decline in the rate of commercial air carrier accidents by major air carriers over the years (Figure 2-1).

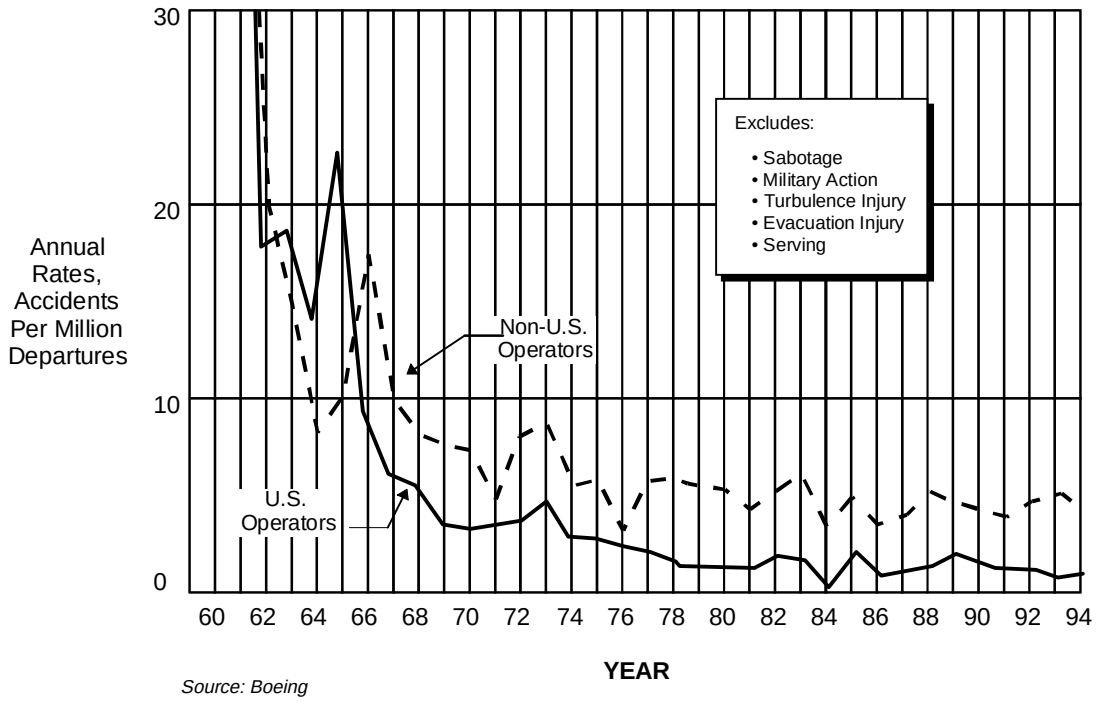
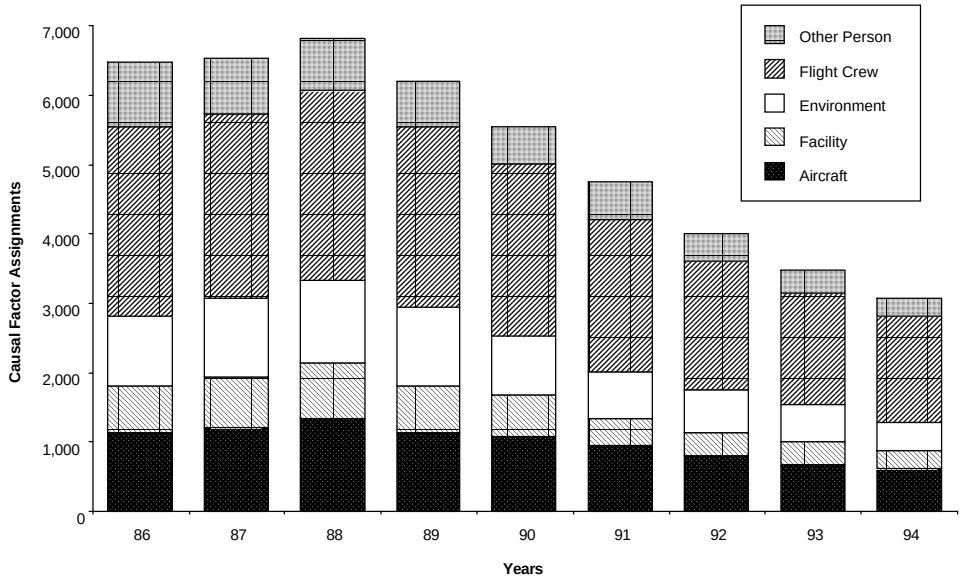


FIGURE 2-1 HISTORICAL AVIATION ACCIDENT STATISTICS

This impressive safety record results in aviation being the safest mode of transportation in the U.S., and thus the public demand for air travel continues to grow. But upon close examination, aviation accident rates of the

large U.S. air carriers in recent years appear to be approaching a steady state — which by public standards is not acceptable. Given that the demand for air travel in the U.S. will likely grow at approximately 3 to 4 percent annually over the next decade, keeping the accident rate constant while traffic continues to rise will mean a near doubling of accidents within 10-15 years. This is troubling to the FAA and to industry, especially in an environment in which the public has come to expect an extremely high level of safety performance. The goal of "Zero Accidents" has been established to better focus FAA and industry efforts on the challenges at hand. Achieving this goal necessarily requires a new sense of purpose on the part of the FAA and the industry it regulates.

The air transport carriers (14 CFR 121), and the scheduled commuter and air taxi operators (14 CFR 135) have comparable safety records. Contrasted with these accident rates, non-scheduled air taxi and general aviation fare much worse, and raise important questions about the safety practices of these segments. As shown in Figure 2-2, the majority of accidents in *each operator class* are caused by factors that include human error, which may be the most difficult to address without instituting cultural attitudinal changes at all levels of the industry.



Number of Primary Causal Factor Assignments in Accidents by Operator Type, 1986-1994

Causal Factor	14 CFR 121	Sched. 14 CFR 135	Non-Sched. 14 CFR 135	General Aviation	Total
Aircraft	292	107	554	7,794	8,747
Facility	28	43	328	4,867	5,266
Environment	112	65	453	7,146	7,776
Flight Crew	399	182	987	19,388	20,956
Other Person	168	79	268	4,904	5,419

Source: National Transportation Safety Board

FIGURE 2-2 ACCIDENT CAUSAL FACTORS

With marginal improvements in the accident rate becoming harder to achieve, the FAA and industry believe that they will need to rethink the fundamentals of their current operating and safety processes in order to improve safety performance. The goal of zero accidents and the challenges of the future environment simply make the status quo untenable, and will place significant demands on AVR, whose fundamental mission is to promote and constantly improve aviation safety. The public debate will not be whether AVR should rethink its role and responsibilities, but rather *how it will lead the way*.

The international safety environment adds another layer of complexity to AVR's "national" mission, and raises the question of international safety leadership. More Americans will travel abroad on foreign carriers over the coming decades. The economies of emerging nations, and the importance of U.S. trade with these nations, will drive this segment to triple in the volume of passengers between now and 2015. Pressures are mounting for FAA to take a more active international safety leadership role. Several initiatives are underway in response to this, one of the most important being the International Aviation Safety Assessment (IASA) program. IASA evaluates the performance of over 100 countries' civil aviation agencies against the ICAO annexes pertaining to aviation safety regulation — agreed upon by these countries several decades ago in order to preserve and promote a uniformly safe and open flying environment. The IASA program, which threatens a cessation of flying rights to the U.S. for those countries who do not comply with ICAO's standards for safety oversight, is having a profound and refreshing impact on under-performing countries.

Key aspects of the future — advances in aviation technology, increasing industry globalization and consolidation, and growth in air travel — are going to raise an entirely new set of safety issues that the FAA and industry will have to address. At an aviation safety conference sponsored by the DOT and FAA in February, 1995, more than 1,000 industry, government and union aviation officials met to address these issues. The initiatives outlined in the resulting "Aviation Safety Action Plan" proposed some key recommendations that hit at the heart of AVR's mission, and these formed the guiding principals of the Challenge 2000 Project.

2-2 Principal Elements of AVR's Safety Regulatory Mission

AVR has a fundamental responsibility to ensure the safety of all participants in the U.S. aviation system — and principally the flying public. In general, AVR's safety regulatory mission is comprised of three primary elements in which it:

- Defines the rules of the aviation system;
- Admits and discharges participants; and
- Monitors compliance.

Through rulemaking, AVR defines the sets of regulations and policies governing the design, manufacture, and operation of U.S. aircraft. AVR certificates and oversees all key participants in the aviation system, including commercial and cargo aircraft operators, aircraft and avionics manufacturers, as well as other participants such as

maintenance organizations, pilot schools and general aviation. Furthermore, AVR enhances the fulfillment of its mission through several secondary functions that include accident investigation, safety research and training. It works closely with, and supports the missions of, several other FAA offices such as the Office of System Safety (ASY), Office of Research and Acquisition (ARA), Office of the Air Traffic Services (ATS), and Office of Civil Aviation Security (ACS).

AVR also operates within an increasingly global regulatory environment. An example of this can be found in recent efforts undertaken to harmonize the U.S. FARs and the Joint Aviation Requirements (JARs) of the European Joint Aviation Authorities. The economic need to accelerate these harmonization efforts is increasing as the manufacturing and airline communities become more global in their scope and operations. AVR is playing a role in harmonizing, to the maximum extent possible, the JAR and FAR rules regarding the operation and maintenance of civil aircraft, and the standards, practices, and procedures governing the design and manufacture of aircraft, engines, and other components.

Because of these roles, AVR's stated national mission to promote aviation safety must be taken in a broader context. The U.S. aviation system, the most extensive in the world, provides infrastructure that facilitates commerce both domestically and globally. The FAA's stated charter is to "*...provide for the regulation and promotion of civil aviation in such manner as to best foster its development and safety and to provide for the safe and efficient use of the airspace...*", a notion which introduces additional stakeholders in the process of regulatory development and execution.

So in addition to the obvious participants in the aviation system, there are numerous organizations that have a vested interest in AVR's continuing effectiveness (safety) and efficiency (fiscal responsibility and economic contribution through promotion of a safe flying system). These include all major economic sectors that depend upon a safe flying system for their well-being — the tourism industry, the air cargo and air freight business, airports and the many service segments supporting air commerce. To these one must add the aviation industry trade associations, the U.S. Congress (AVR activities are regularly overseen by numerous Congressional committees), the General Accounting Office (GAO), the DOT's Office of the Inspector General (OIG), the independent National Transportation Safety Board (NTSB), their staff and union employees, and finally, the nation's taxpayers.

2-3 Legislative and Regulatory Environment in Which AVR Inspectors Must Operate

The principal enabling statute that defines the FAA's mission, structure and processes is the Federal Aviation Act of 1958 (FAA Act). In addition to the FAA Act, AVR is directly or indirectly affected by several other statutes. For instance, AVR must attune its processes to the Trade Agreements Act and the National Environmental Policy Act (NEPA). The latter significantly impacts AVR's regulatory and certification processes when issues such as aircraft noise and emissions have to be balanced against the economic benefits of aviation. AVR is also subject to oversight by the Executive branch, manifested in the form of numerous Executive Orders (E.O.s) with which it must comply. For example, E.O. 12866 recommends more discipline in the initial drafting of rules and imposes cost-

benefit obligations upon FAA when introducing new rules. Under the current rulemaking process, however, its effect is the need for more personnel to ensure compliance.

The Federal Aviation Regulations, or FARs, are all rooted in the FAA Act. The FARs and statutes which frame the regulations ultimately shape the AVR work force's roles and responsibilities. For instance, an inspector's fundamental purpose is to ensure industry or designee compliance with the FARs. In fulfilling this role, inspectors are assisted by lengthy manuals (e.g., Air Transportation Operations Inspector Handbook) , Airworthiness Directives (ADs), Special Conditions (SCs), Advisory Circulars (ACs), and Flight Standards Information Bulletins (FSIBs), to name but a few. This results in an ever changing and complex regulatory environment for the work force, made more so by often inadequately defined lines of communication between customers, field offices, regions, and headquarters (Figure 2-3).

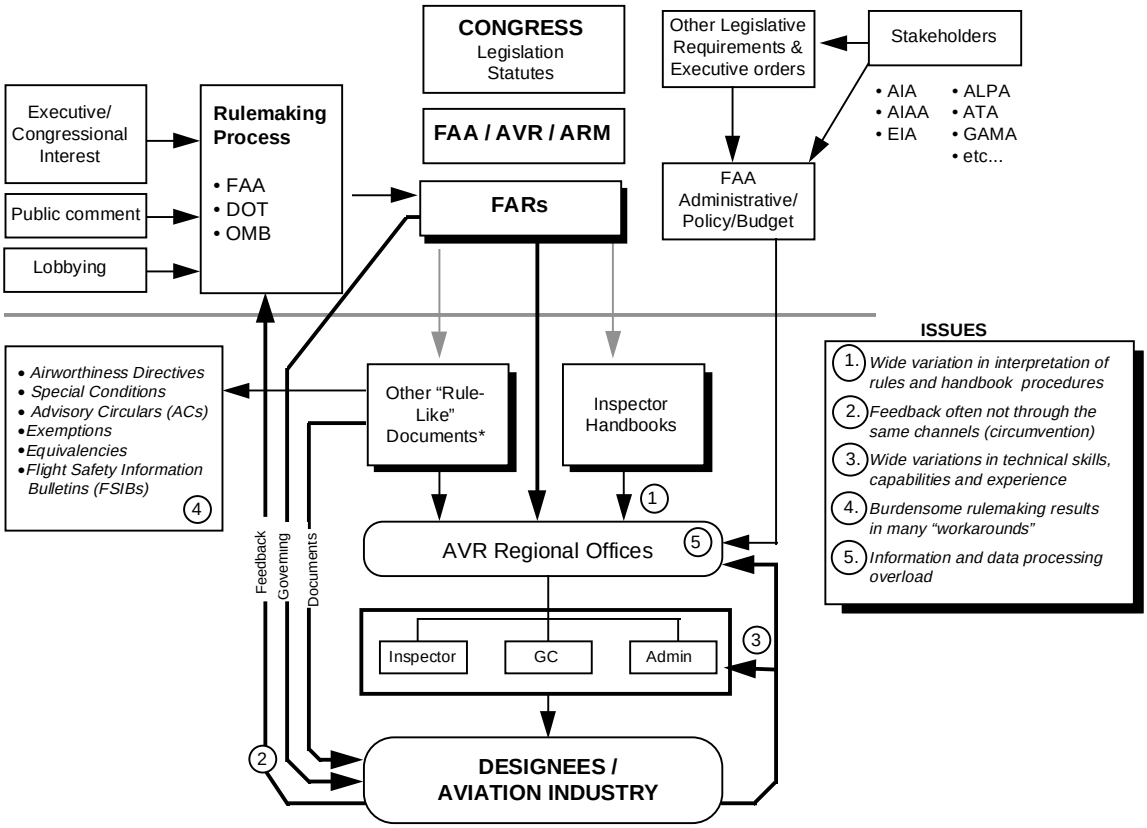


FIGURE 2-3 REGULATORY ENVIRONMENT AND ISSUES

Virtually all of this complexity is captured in slow-moving paper. The FARs contain a mix of modern and dated regulations in constant need of re-interpretation as the aviation system evolves. This produces wide variations in interpretation by inspectors, supervisors, and policy managers. As will be discussed later, AVR has a wide variation in technical skills and experience, adding to the complexity of its processes.

While the industry that AVR oversees is indeed complex, the regulatory system itself thus begins to drive workload and efficiency, both of prime concern to the Challenge 2000 Project. Defining the rules of the aviation system has led to complexities that of their own right now drive workload for AVR as well as for members of the regulated community. The federal regulations become more and more elaborate every year. Workload expands, and important issues affecting efficiency and safety effectiveness often go unresolved.

Further exacerbating this environment is the burdensome and over-managed rulemaking process itself. Although rulemaking teams are established for each rulemaking initiative, each project progresses through a series of reviews at various supervisory and managerial levels, both within and outside the FAA. While these reviews ensure the project has been critically analyzed, they can be time consuming. The issues addressed in rulemaking are often technically complex and economically costly. Senior policymakers within FAA and the Office of the Secretary (OST) and the Office of Managements and Budget (OMB) must have a thorough understanding of the proposal, the alternatives considered, and the recommendations made by the team before the project can be approved. Because reviews of a rule often occur in series--from the team, through multiple layers of FAA management, to several organizations within OST and finally to OMB--issues can be revisited several times and valuable time can be lost.

Thus, the legislative and regulatory environment in which AVR operates is continuously evolving and is increasingly complex. Any changes that AVR needs to implement in order to address the challenges of the future must be examined in light of this. The Challenge 2000 Project examined this area carefully when formulating the elements of the Challenge 2000 change program.

2-4 Organizational Structure and Deployment of Resources

AVR is organized into five services: Flight Standards (AFS); Aircraft Certification (AIR); Aviation Medicine (AAM); Rulemaking (ARM); and Accident Investigation (AAI). Table 2-1 highlights the specific areas of responsibility of each service, employing some 4,700 personnel. AVR is unique in the world in its “designee” program, extending its oversight through approximately 12,400 persons or groups of individuals who are employed by industry but are legally authorized to carry out AVR’s services, such as certification activities and medical examinations of flight crews. Engineering Representatives, Manufacturing Inspection Representatives, Mechanic Examiners, Designated Airworthiness Representatives, Aviation Medical Examiners and Designated Pilot Examiners make up this work force. Thus over 17,000 personnel are involved in aviation system oversight.

The current structure and deployment of resources is, in part, a reflection of the regulatory environment into which the organization was born many decades ago. The majority of AVR resources was originally distributed throughout the regions of the United States in order to:

- Mirror the footprint of the industry at that time; and
- Minimize response time associated with interpretation of policies and regulations.

As the geographic distribution of operators and manufacturers changed over time, this regionally based structure led to conflicts in interpretation of standards/policy as well as in resource management. While the "straightlining" of AVR in 1988 consolidated support and ownership of resources and policy in a centralized community, parts of the regionally deployed management infrastructure and regional overheads remain intact. Geography is an important aspect of AVR's mission, as inspections must be performed in every state in which manufacturers or airlines operate. This is one of the least flexible aspects of AVR's resource options. With 167 offices nationally and internationally, comprising FSDOs, ACOs, MIDOs, etc., closing or consolidating offices is an unattractive choice for a Federal agency.

Service	Primary Functional Responsibility	Employ-ment	Locations
AFS	♦ Certify operators, air agencies (pilot schools, third party maintenance providers, etc.) ♦ Monitor compliance of operators and agencies ♦ Maintain operations policy and regulation	3,574	HQ, Regional HQs, AAC, FSDOs
AIR	♦ Certify manufacturers, aircraft, and aircraft design ♦ Support continued operational safety of aircraft in service ♦ Maintain production and airworthiness policy and regulation	883	HQ, Regional HQs, ACOs, MIDOs
ARM	♦ Manage the FAA's rulemaking process	25	HQ
AAM	♦ Medical certification of airmen ♦ Oversight of industry drug and alcohol abatement programs ♦ Conduct aviation safety and medical research	359	HQ, Regional HQs, CAMI
AAI	♦ Manage investigation of aviation accidents	27	HQ
AVR-1/10	♦ Support to Associate Administrator	19	HQ
Designee Work Force			
Designees	♦ Engineering Representatives ♦ Airworthiness Representatives ♦ Manufacturing Inspection Representatives ♦ Mechanic Examiners ♦ Aviation Medical Examiners ♦ Pilot Examiners	12,400	Industry locations, domestic and inter-national

Source: AVR-10, FY95 data

TABLE 2-1 AVR SERVICE RESPONSIBILITIES

AVR has maintained an organizational segregation which distinguishes between the operation and design/production of aircraft. AFS and AIR account for over 90 percent of the personnel and budget of AVR, and provide most of AVR's ongoing services. Though AFS and AIR jointly support the transition of aircraft from production to operation through a joint Aircraft Evaluation Group (AEG), the focus of the interface is very specific. While ARM has a small staff, it takes an active role in defining the aviation system through its oversight of the rulemaking process. These functions are central to AVR's primary mission of aviation safety and effectiveness, and consequently, *Challenge 2000* has focused primarily on these three offices.

AVR's inspector, engineering and administrative work force is presently comprised of a wide array of aviation and non-aviation skills and experience. The two largest services, AIR and AFS, comprise some 90 percent of all AVR resources. While their responsibility profiles are similar, 75 percent of the work force of AIR is comprised of postgraduate and undergraduate level engineers and technical professionals. By contrast, only 1 percent of the AFS work force holds a postgraduate degree, while less than 30% have a bachelor's degree. This is important for two reasons. First, these organizations need to be further integrated in the future, but the wide variation in skills and educational levels pose tough cultural hurdles. Second, due to the burden of oversight among the larger air carrier sector, AFS will bear the greatest burden of AVR's responsibility for aviation safety moving forward, but may be ill equipped to manage this responsibility.

On average, AVR's line and engineering work force has close to 10 years of on-the-job experience. Because many AVR inspectors have spent 10 to 20 years in the industry they oversee before coming to AVR, the physical age of the work force is high, averaging 48 years. So the potential for experience and technical skill loss due to retirement is high (the shaded area in Figure 2-3). While budgetary constraints have limited AVR's flexibility for redeployment of resources and redefinition of its work force, AVR has recognized that the aviation environment in which it operates is changing. One of the issues considered by the Challenge 2000 Project has been: As permitted by attrition, what new set of skills and abilities should be hired in, and at what pace, to position the work force for the 21st Century?

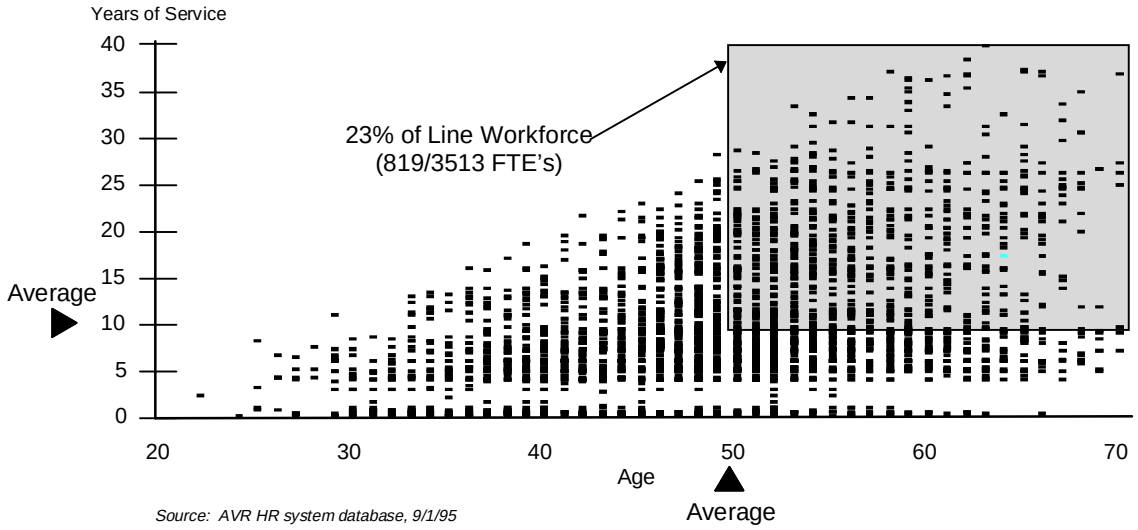


FIGURE 2-3 AVR INSPECTOR AND ENGINEER DEMOGRAPHICS

In its 1995 Business Plan, AVR stated that "*a changing aeronautical environment was having a profound impact*", citing air traffic growth over the next 10 years, expanding international markets, the challenges of harmonization, increased use of GA aircraft for business, and the regulatory burden on the aviation community.

These matters led to AVR's own analysis of work force and process reengineering needs. Several transactional programs were underway as the Challenge 2000 project began in August 1995, some of which are worthy of note. For example, the FRESH AIR project closely examined AIR's organization and structure; the Safety and Performance Analysis System (SPAS) is currently being developed by AFS to handle resource deployment issues, while ARM has taken steps to refine and streamline the rulemaking process.

In fact, to aid in workforce efficiency and to provide management decision tools, over 45 individual service systems were being developed or deployed that addressed AVR's product and service needs through technology, work force automation and efficiency, or system safety improvements. However, in the context of AVR's present national mission and future challenges, this transactional, "bottom up" approach to organizational change could be inefficient, as:

- Transactional process reengineering and automation/system development require constant adjustment as the organization reacts to external changes in the absence of a top-level framework;
- Sub-optimal interfaces and "liaisons" between those responsible for these transactional processes need to be modified to accommodate shifting environmental requirements, requiring valuable resources; and
- The regulated industry and other international regulatory authorities will find costs of compliance increasing as they strive to maintain alignments with multiple interfaces within AVR.

The opportunity exists now to take a more holistic view, and initiate a top-down driven "Change Program" which will systematically and efficiently reposition AVR, its processes, services and systems, for the next decade. Given the statutory, budgetary, and policy environment within which AVR operates now, adapting to the changes in its environment will take many months of lead time and should be started now.

2-5 External Concerns of AVR Performance in Safety Regulation

Most of the FAA/AVR's customers — manufacturers, airlines, and others — as well as the general public state that overall the agency and its offices perform a necessary and valuable service in fulfilling their regulatory roles in the current time frame. Specifically, some expressed belief that AVR performs its mission reasonably well today, that it is effective, and, "*not broken*". A consistent theme was that the cost of compliance imposed on industry needed to become an integral part of the regulatory dialog between FAA and those being regulated, and that AVR could find and pass on "efficiencies" without jeopardizing safety.

However, the findings regarding the future are quite different, and are entirely consistent with our independent analysis in support of the Challenge 2000 Project. In general, consensus emerged among the external program participants (Table 1-1), later confirmed by our analysis or by AVR, regarding the following:

- It is critical that AVR work in concert with industry to reach a higher level of safety performance. AVR will need to change its approach to regulation and enforcement if it is to meet the challenges of the future with fewer resources;

- Further regulations alone are clearly not the answer to meeting these challenges. Partnership with industry and a move toward more cooperation would be necessary to move to the next level of safety;

- Delegation has worked successfully in the past; however, program-level delegation may be more effective, while at the same time providing industry with needed flexibility to manage its affairs more efficiently. The so-called "Partnership Program" established between FAA and several of the largest U.S. carriers, was widely cited;

- There is increasing concern about the inability of AVR to maintain technical proficiency and currency in the face of some new and rapidly advancing technologies;

- For the air carriers and other operators, the regulations are often ambiguous, subject to wide variation in interpretation, and need to be simplified and consistently implemented;

- AVR is not as effective internationally because it lacks critical tools and resources. International harmonization of rules and standards is fast emerging as an area that will require AVR to acquire new expertise and work force capabilities; and

- The regulatory process is overly burdensome and politicized, and urgently needs to be streamlined in order to facilitate its improvement.

Over the years, the GAO has repeatedly raised issues that it believes must be addressed by AVR for the future. In its 1991 report "*Aviation Challenges on the 1990s,*" the GAO identified rulemaking as an area that was unresponsive to customer needs. Five years later, this criticism has increased within the aviation community. The DOT's Office of the Inspector General has also highlighted some areas of concern regarding AVR's safety and regulatory responsibilities. These investigations have focused on AVR's ability to ensure the quality — and by inference, safety — of maintenance facilities and foreign supplied parts as well as the qualifications of medical and designated mechanic examiners. The Challenge 2000 Project sets a new framework that will address, in time, all of these concerns.

3 THE FUTURE AVIATION SAFETY REGULATORY ENVIRONMENT AND ITS IMPLICATIONS FOR AVR

The Challenge 2000 Task Force has identified a score of current and future environmental factors that have implications for the safety regulatory mission of FAA and AVR. Below are some of the most significant of these factors. We discuss the current AVR practices designed to address some of these factors, and the implications for its future mission, organizational structure, resource allocation, and work force skills.

3-1 Technological Change Will Present New Challenges for AVR

While the rate of introducing design improvements in major components of an aircraft is slowing, information management systems are revolutionizing the methods of design, manufacture, and control of these fundamental structures. This phenomenon is typified by new commercial aircraft production, and also is found in other industries where information technology is having a profound impact. As depicted in Figure 3-1, there have been very few changes in core design in the past 50 years. This reflects a mature technology foundation in airframes, and a highly predictable rate of change in many other aircraft components, including most mechanical components and materials. Incremental improvements in engine performance now involve increasing technological sophistication; however, a 1-2 percent efficiency improvement often gains enormous cost savings for operators.

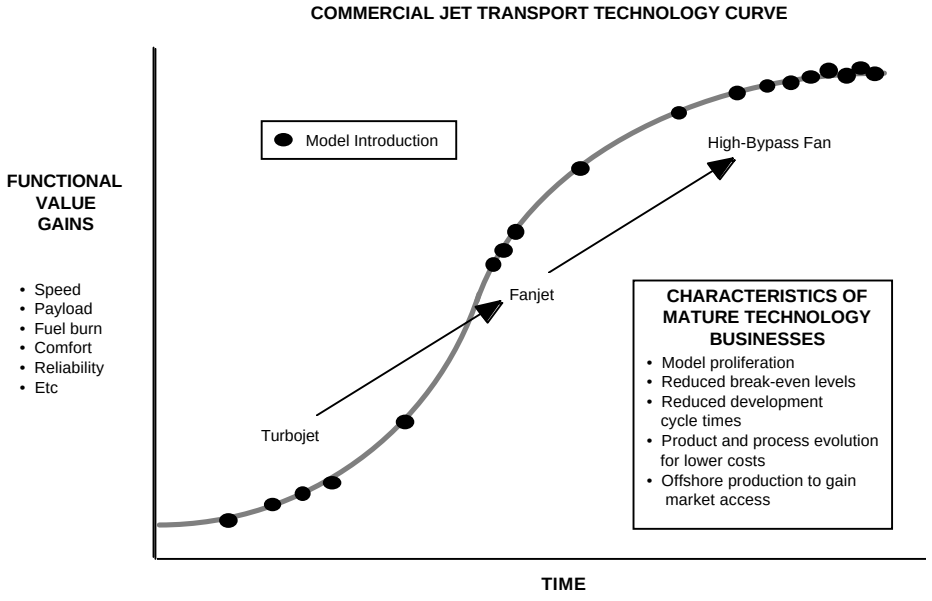


FIGURE 3-1 EVOLUTIONARY CHANGE IN CORE TECHNOLOGY AND RESULTING FUNCTIONAL VALUE GAINS

On the other hand, manufacturers have found that differentiated product advantages can often be achieved by tailoring major aircraft subsystems to fit the specific needs of their customers, with operational economic benefits to support the tailoring cost. This is driving up the number of aircraft "derivatives" and "variants" with the associated challenge to shorten and reduce the costs of product development and certification. Boeing has seven to

nine significant variants of its 747, 757, 767 and 777 fleets, and the new 747-500 will be considered by Europe's JAA as a "new" aircraft because of extensive internal modifications. Further, manufacturers are using sophisticated design and production tools such as Computer Aided Three Dimensional Interactive Applications (CATIA) to gain true efficiencies in their manufacturing processes, and to reduce times needed during the aircraft design cycle.

Implications for AVR: *To respond to this in past years, AVR has stepped up deployment of engineering certification resources at the aircraft certification offices (ACO), and each ACO is taking steps to use information technologies such as Continued Airworthiness Assessment Methodologies (CAAM) as decision support tools in support of their individual programs. Pressures will mount for AVR to become more responsive, to have the skills, resources and tools at its disposal to certify more new aircraft over diminishing development cycles. However, as design cycle times become shorter and shorter, and aircraft sophistication increases, workload will grow, and certification and inspection complexities will increase. New production technologies will drive up the cost of certification as new testing procedures evolve and widen the gap between industry capabilities and AVR's present work force skills and tools. While AVR carries enormous responsibility, it has less than 10 National Resource Specialists (NRSs) available with which to address critical issues, and aid in strategic safety program design.*

In another fast-changing area of technology, information management has created opportunities for tailoring aircraft performance through integration of previously independent systems. As an example, full authority digital control allows the synthesis of information from a variety of systems. In addition to linking the engine with the aircraft's flight management system, performance data can be shared with an on-board health monitoring system that simplifies maintenance through more robust fault diagnosis and lifecycle management. As an example of the increasing usage of software-intensive systems, the Boeing 777 incorporates a total of 187 computers that require 7.5 million lines of software code.

Information-based technologies will continue to proliferate both in the new generation cockpits (for example, digital flight data management systems that integrate navigation, communication, and operational function), in aircraft operations, and in older fleets through the installation of flight management systems, new engines, or electronic systems. Many technologies will also be utilized in the development and implementation of maintenance management software, parts and component tracking systems, statistical process control, performance control, and systems for flight and reliability analysis.

Information technologies are raising compelling issues for AVR, by contesting its traditional approach to new aircraft certification, flight operations inspections and maintenance oversight. For example:

- New aircraft now rely upon sophisticated systems that transcend the historic division of aircraft structures, power plants and avionics, the basis on which many AVR resources and processes are organized; and

- New certification requirements raised by added ground-air system complexities conflict with the traditional partitioning of aircraft, ATC systems and flight operations within FAA.

Within the aircraft, software now drives value — more than hardware. Modern engines such as the GE90, the Rolls Royce Trent, and the Pratt & Whitney P4084 include sophisticated avionics designed to monitor fuel economy and fine-tune in-flight performance. Where engines used to be controlled by fuel valves, cables and levers, today this has dramatically changed. A series of electronic components provides for greater efficiencies, reduced maintenance and greater safety and reliability, reducing operating costs and extending engine life — major benefits for the airlines.

Implications for AVR: *AVR today has specific programs that address information technology and the challenges of safety, reliability and certification within the aircraft. The CAAM program within AIR and other risk mitigation tools are presently under development. The ACSEP program has been implemented and provides better synthesis and exception reporting capabilities for AIR. For AFS, the SPAS will enable more efficient resource deployment and highlight risky areas of operations in the near future. AFS has also sought broad industry participation in the development of the Advanced Qualification Program (AQP). Cross system risk mitigation requires an integrated approach to certification. In the past the ACO responsible for engine certification or avionics could rely upon a small team of resident specialists to work with a manufacturer through testing or certification. Today integrated teams of specialists are drawn from across AVR and assigned to a certification program, and upon completion, sent back to their regions or directorates. Complex organizational linkages with growing functionality are being constantly established and then torn down to accommodate this process. Increasingly, AVR will need to accommodate these kinds of requirements with improved communications across all functional boundaries of the organization, and will need a formal means by which intellectual capital can be accumulated and redeployed against future (and tougher) problems.*

All the while, new and compelling satellite communication, navigation and surveillance systems are being developed, promising unprecedented economic benefits. Consider the complexities of the integration of aircraft, satellite-based, and ground-based components of satellite CNS/ATM systems. As shown in Figure 3-2, difficulty in creating a standard for implementation of GPS in the international civil aviation community highlights the increased complexity of AVR's certification effort. The aircraft, its avionics and flight crew, the satellites and ground tracking networks are individually purchased, managed and maintained by dozens of agencies and companies across many national boundaries. Within FAA alone, the program to certify the Wide Area Augmentation System will involve large teams and coordinated efforts of AVR, ATS, ASY and ARA, the office responsible for its design. Should the system be proven and declared “sole means” in the next century, aircraft will be modified and flight crews retrained for the use of satellite systems for oceanic, enroute, approach and Category I landings. Foreign operators will be required to carry such equipment if they are to be allowed to operate from and to the U.S. International CAAs will seek reciprocity with their satellite CNS/ATM systems and programs, perhaps quite different in architecture from the WAAS.

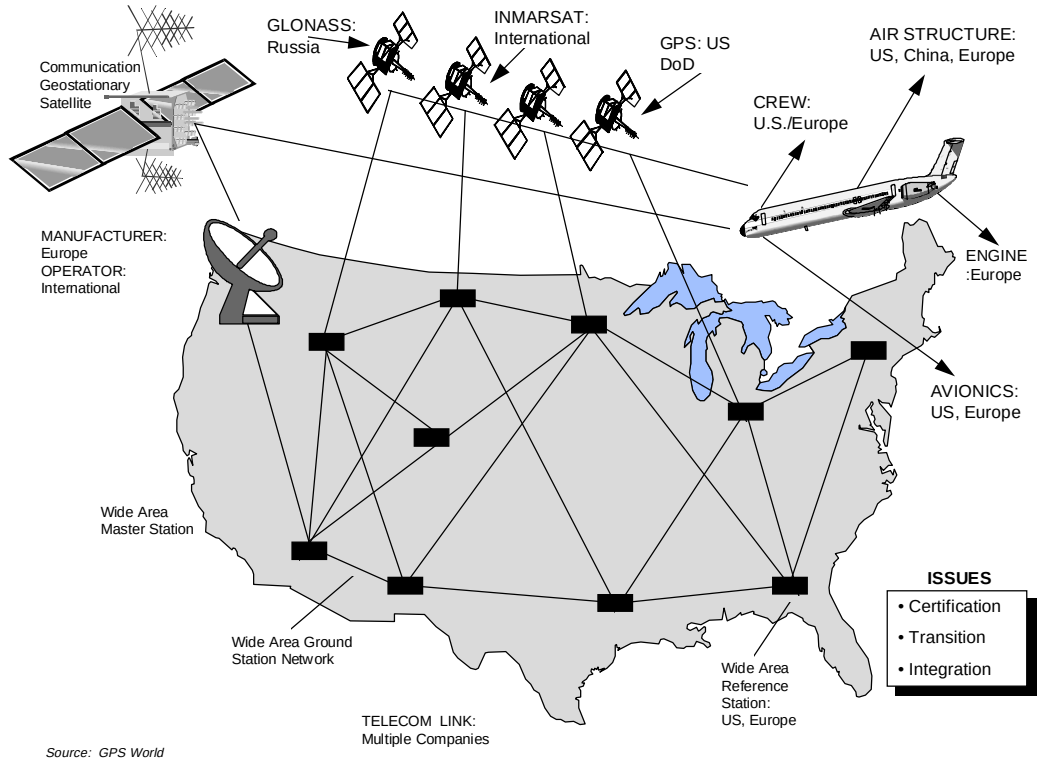


FIGURE 3-2 THE INCREASINGLY COMPLEX SATELLITE-TO-AIRCRAFT-TO GROUND OPERATIONAL FLIGHT ENVIRONMENT

Human factors are a principal cause of, or contributor to, accidents, and thus become more critical as the complexity of the "system of systems" grows. Evolving flight deck designs have automated many flight crew tasks that have reduced and eliminated some types of flight crew errors, but have introduced other paths for error. Recent accident and incident data appears to highlight difficulties in flight crew interaction with increasingly complex automation/information-based technologies.

Implications for AVR: *The regulation and certification office has structured its activities around the traditional partitioning of aircraft, ATC systems and flight operations. In the past, AVR could certify and then oversee individual components of the aviation system. Both flight operations and system design expertise is required to test new satellite, avionics and ground systems for safety compliance, and the work force will require capabilities to respond to the more sophisticated environment accordingly. Today, to meet the challenge of fielding these systems in a safe and timely manner, the work entails participation in integrated product teams across the entire FAA, including the offices of the Air Traffic Service, Research and Acquisition, and the Office of System Safety. These teams will also need the skills to work in a truly international arena.*

The continual, rapid technological change complicates AVR's current certification and compliance oversight significantly. Policy making will increasingly require sophisticated understanding of cross-system issues, and international harmonization will play an increasing role. Heightened awareness of human factors, a primary

cause of accidents, and related information technology issues will also give rise to the need for new policies, regulations, and certification methods, and most importantly, work force skills.

3-2 Globalization of the Industry Complicates AVR's National Mission

The aircraft manufacturing industry in the U.S. and Europe is maturing. As a result of this, and with the technology change curve at or near its limit in traditional, labor intensive system components, there is increased competition among the highly developed countries in design and production . This in turn is causing manufacturers to reduce their recurring product costs, usually by outsourcing production to more favorable production environments in countries such as China and Korea. These countries are lower wage and, more importantly, capable of matching Western standards of product craftsmanship and quality.

The added benefit of this trend toward outsourcing is that national buying preferences can be swayed. Emerging industrial economies are seeking a niche in the global aerospace manufacturing community. A country that builds indigenous aerospace manufacturing capabilities also makes possible a host of "spin off" products and enterprises. Established aircraft manufacturers will source parts and structures from foreign suppliers to gain access to commercial markets in those countries as well as often to meet military offset requirements.

LARGEST AEROSTRUCTURES SUBCONTRACTORS:
Commercial Air Transport Aircraft

CONTRACTOR	APPROXIMATE 10 YEAR VALUE OF CONTRACTS CURRENTLY HELD ($Billions)	MAJOR CUSTOMERS			
		Boeing	Airbus	MDC	Other
NGV (U.S.)	$5.5	●	○	○	○
MHI (Japan)	$4.0	●	○	○	○
KHI (Japan)	$3.4	●	○	○	○
Alenia (Italy)	$2.4	◕	○	◔	○
Canadair (Canada)	$2.1	◔	●	○	○
FHI (Japan)	$2.0	●	○	○	○
Shorts (UK)	$1.8	◔	○	○	●
Xian (China)	$1.8	●	○	○	○
Textron (U.S.)	$1.7	◔	◕	○	◑
KAL (Korea)	$1.7	◑	◑	◔	○

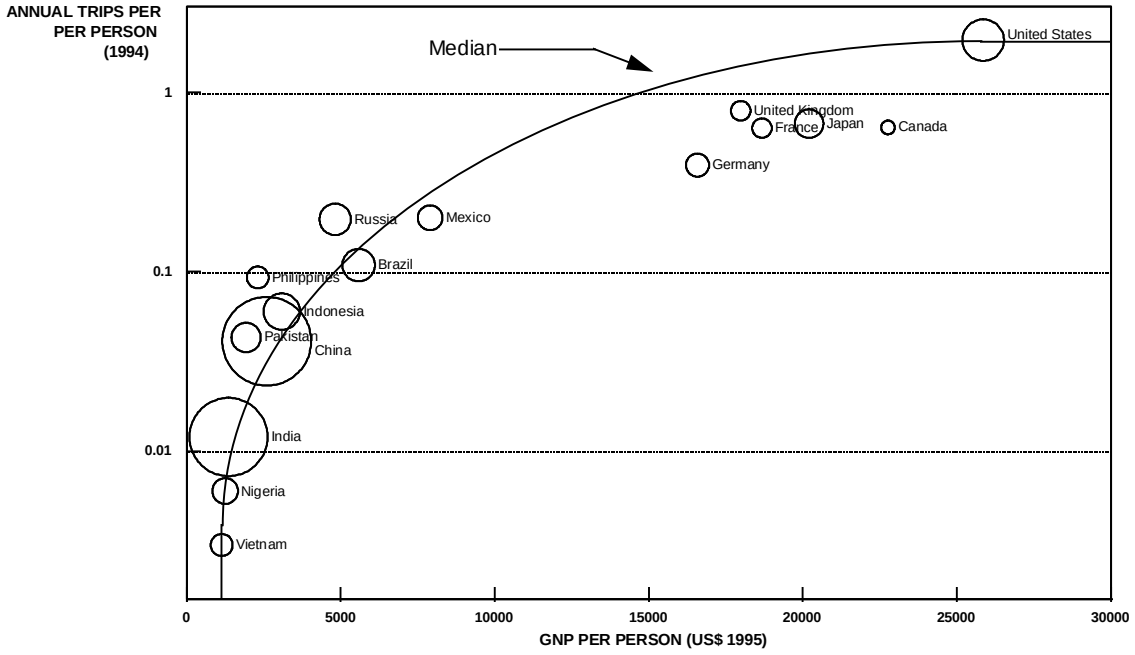
● Major
↓
○ Minor

FIGURE 3-3 GLOBALIZATION OF AIRCRAFT MANUFACTURING

Thus U.S. aircraft manufacturing is no longer domestic but is increasingly global. As shown in Figure 3-3, the contribution of three Japanese manufacturers — Kawasaki, Fuji and Mitsubishi — to the Boeing 777 design and production is an indicator of the phenomenon. Japan's economic leverage over primary producers of air transport products has become significant in recent years. Japan will begin to develop its own manufacturing capability in the decades ahead.

The growth of the air transport market due to increasing demand for air travel portends a shift in global patterns of trade and affluence — growth is highest in the Asia-Pacific region, followed by South America, Europe, and then North America. As shown in Figure 3-4, a strong correlation exists between per capita GNP and the use of air as a preferred mode of travel. With large populations and land masses, emerging nations will be major future consumers of U.S. and European aircraft as their economies catch up with those of the wealthiest nations. Since two of the three major commercial aircraft manufacturers are U.S. companies, the pressure on these domestic manufacturers to continue to outsource will increase, despite organized labor pressures.

Consequently, desired oversight of design and production cannot be easily achieved where direct control is not possible. This is further complicated by cultural differences between countries. The issue of duplication of certification costs must also be considered, especially if foreign production/design continues to cause additional costs by duplicating U.S. and foreign, principally European JAA, certification efforts.



Source: ICAO, OECD

FIGURE 3-4 TRAVEL AND RELATIONSHIP TO GNP PER CAPITA - MAJOR ECONOMIC OR POPULATION CENTERS (CIRCLES PROPORTIONAL TO POPULATION

Implications for AVR: *All the factors described above have an impact on AVR, since it must accommodate this international shift within its own national charter and responsibilities. AVR will not be granted relief in its oversight and certification of the manufacturing community, but in fact will be required to oversee even more aircraft manufacturing activity either directly (through its designees) or indirectly (through foreign CAAs). Increasing pressures to harmonize will become more visible as the next decade approaches. Today ongoing manufacturing surveillance is largely contact driven, through AVR programs such as ACSEP. The FAA has countered with an incremental approach to foreign manufacturing harmonization through Bilateral Airworthiness Agreements (BAAs) and recently the expanded Bilateral Air Services Agreements (BASAs), in place with the U.K., Canada and the Netherlands.*

The compelling challenge then is for AVR to continue its safety critical mission of regulating an industry which has become increasingly integrated and global in scope. While AVR is now able to accommodate customer demands (e.g., Boeing 777 certification), the increasing global manufacturing environment will considerably complicate AVR's regulatory mission, and will require AVR to rethink its criteria for hiring and training its employees. Additional skills will be needed to cover the international character of issues (language, cultural sensitivity, international experience) which are not currently part of AVR's work force requirements. Access to technical expertise will become even more essential in the future as the industry continues to drive new technology for enhanced performance. Business management priorities, including organization and bottom line costs, will continue to drive the industry and will ultimately have their effects on AVR.

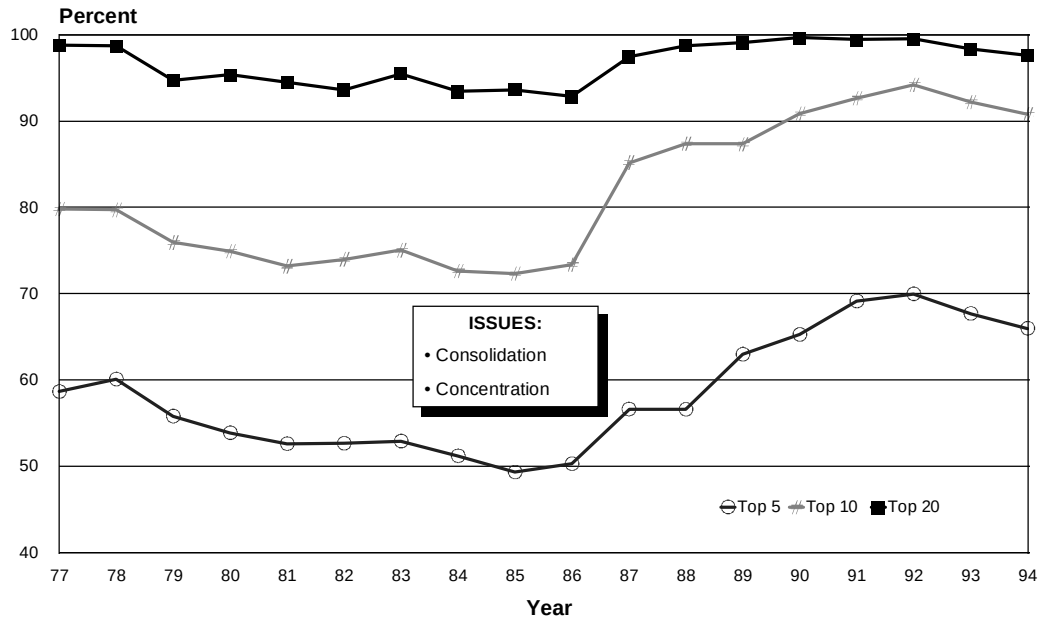
3-3 Airline Consolidation and Global Alliances Place Different Demands on AVR's Geographic Organization and Resources

After the deregulation of the U.S. airline industry in 1978, there was a surge of new entrant carriers. In the mid-80s, a wave of consolidations took place as carriers sought network and scale advantages, and there was relatively liberal approval of merger activity. Another smaller upturn in the number of new airlines took place earlier this decade due in large part to low fuel costs, attractive leasing arrangements, a large supply of aircraft, and a strong economy. However, as the fundamentals have shifted, and despite 1995's record year for airline profits, the environment has become less favorable for air carriers operating below needed levels of scale and breadth. With barriers to market entry rising, consolidation pressures have become stronger once again.

Today, the consolidation will increasingly result in a segmented airline industry, especially within the Part 121 carriers. In addition, fewer, larger airlines with increased market share will tend to dominate the industry (Figure 3-5). The top 10 carriers today account for some 90 percent of passengers, compared with 70 percent a decade ago. On the other hand, smaller, principally regional carriers with their own unique requirements will continue as important industry players. While large carriers will consolidate further, a "churn" in the smaller airline market has to be acknowledged.

There are significant safety consequences of these trends as the industry further stratifies. The larger, more capable top carriers, are often well financed and managed, and have developed excellent safety records. They have

constantly sought out the most efficient and effective business practices to improve their operations and reduce accidents or incidents. Often these programs involve the installation of a broad-based safety culture and attitude within all managerial levels. As these larger carriers acquire smaller carriers or enter into marketing arrangements with commuter fleets to feed their hubs, many of these safety practices become adopted by their smaller counterparts.



Source: US DOT

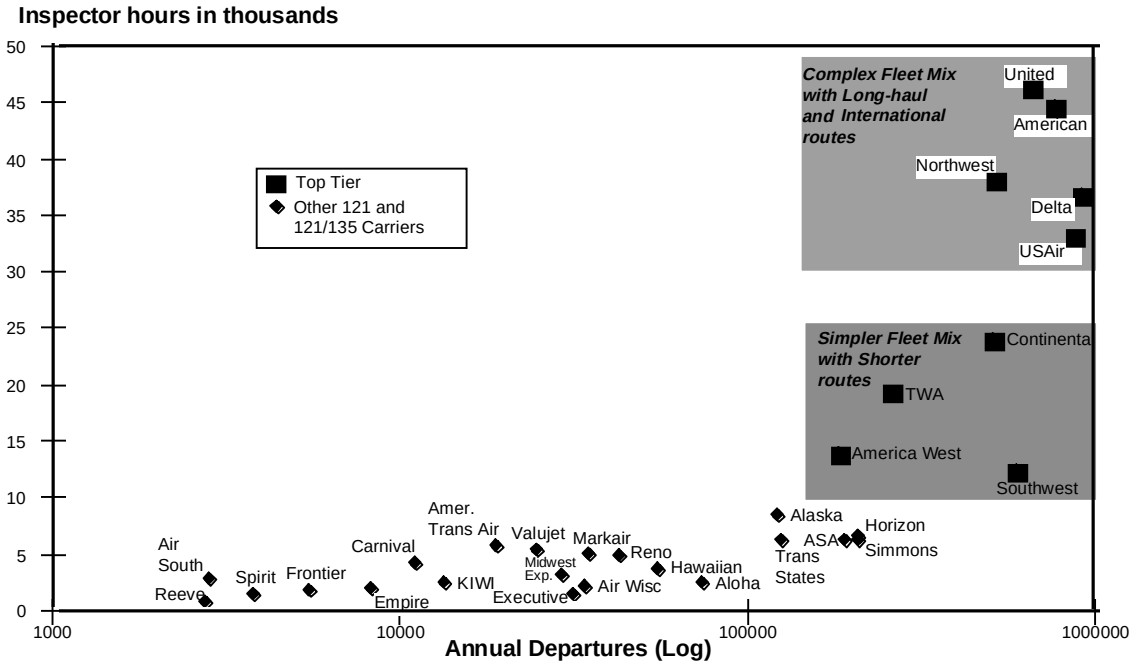
FIGURE 3-5 MARKET SHARE OF DOMESTIC CARRIERS

In the international area, "code sharing" and increasingly integrated operations, including maintenance and overhaul, are becoming more and more prevalent as a cost-effective means of developing international networks. As a result, strategic international alliances have and will continue to proliferate among carriers around the world. Certification issues and complications arise from regulating allied carriers (e.g., British Airways and USAir) as well as third party maintenance organizations and maintenance stations located abroad.

Implications for AVR: *In summary, AVR is increasingly facing fewer large, global, and more capable airlines. It has started "partnership programs" with major airlines to leverage their capabilities to achieve higher levels of safety performance, at the same time permitting AFS to allocate its inspection work force differently, concentrating upon the less capable carriers with greater safety problems.*

Although AVR is still largely organized to serve all carriers regardless of their size and performance, it is often the case that carrier capabilities are proportional to their size, including many areas that have safety related consequences. The large carriers benefit both from economies of scale and also often have greater resources with which to make investments in enhanced programs. Examples include parts reliability and flight training programs. Currently, there is no systematic difference in dealing with a small regional 121 carrier and a major, global airline.

AVR does differentiate in certain areas (e.g., exemptions from FARs for pilot training, etc.), but overall, the applied oversight does not reflect the differences in capabilities of the carriers. This can be seen in Figure 3-6, which shows that AFS spends most surveillance resources on the major carriers.



Source: 4QFY95 PTRS Surveillance by Customer Database, Form 41 Data

FIGURE 3-6 AFS RESOURCE DEPLOYMENT VS. CARRIER CYCLES, FY95

With the increasing capability gap between the major and smaller airlines, AVR will encounter problems with its current distribution of resources in a regionally focused organization which does not adequately reflect the national and global dimension. While AVR's current solutions and initiatives (e.g., Certificate Management Units or CMUs, partnership programs) seek to address this concern, fundamental changes in organization, work force capability and means to shift roles and responsibilities in this polarized environment are nonetheless needed.

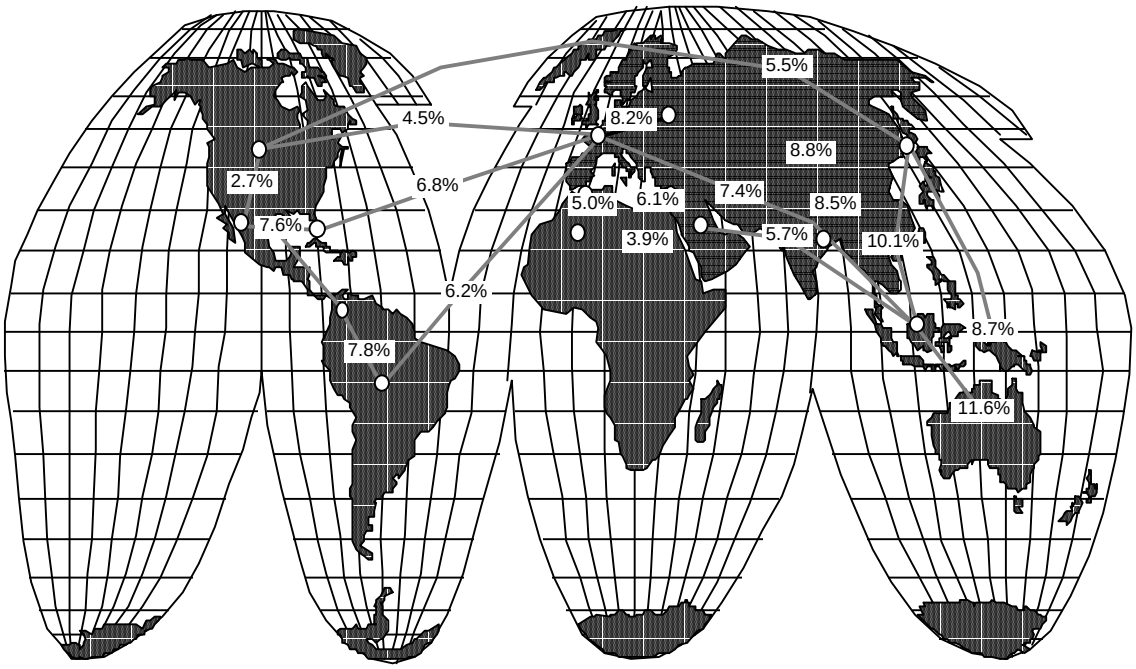
3-4 System Traffic and Changing Future Patterns of Aviation

Global travel will encounter a shift of growth to new and different geographic regions. For example, the growth in air transportation, with an increasing international dimension, will cause a decrease in the U.S. carrier market share in global transportation. The 40 percent share of world airline revenue in the mid 1980's will drop to less than 25 percent by the year 2005. This will inevitably mean less U.S. domination and influence outside U.S. borders. While relative influence will decline, the number of U.S. passengers traveling abroad will increase at a 5 percent pace for the next decade. Figure 3-7 provides a glimpse of where the growth can be expected in major international routes.

More reliance upon foreign civil aviation agencies will be needed to address international safety. Foreign airlines and civil aviation agencies have varying skill levels and competencies, however. The recently instituted

IASA program underscores the importance of FAA leadership in international safety program development and delivery.

Implications for AVR: *In addition to the growth of air transportation, the patterns of growth place new challenges upon the organization. While international safety regulation is not within AVR's current national mandate, the public, Congress, and industry are urging more and firmer leadership. AVR has several means at its disposal with which to influence performance outside its borders, including trade sanctions (IASA Program), harmonization (many countries are presently harmonized to the FARs), and influence through the manufacturing sector (foreign parts regulation). This will result in higher workload for AVR, requiring different skills, and perhaps a new and expanded mission.*



Source: ICAO 1995

EXHIBIT 3-7 PROJECTED GROWTH IN REGIONAL AIR TRAFFIC FLOWS (1995- 2000)

3-5 AVR's Current Position Relative to the Changing Aviation Environment

AVR has recognized many of the above developments in the future aviation environment and has various initiatives underway to cope with them. These are focused on solutions that fit today's organization. But on its present course, Booz·Allen & Hamilton believes that AVR could be unable to cope with the accelerating change it will face in the years ahead. For example:

- Because the aviation system continues to grow, work volume is increasing for AVR. However, a flat or declining budget in the near future without the benefit of comprehensive process reengineering first being completed would mean that productivity would need to increase by 10% annually to match

increased system volumes. This may not be achievable without fundamentally restructuring the mission and/or AVR basic operating model.

- Related to productivity, resource deployment is generally inefficient by virtue of a disproportionate application of surveillance against the nine largest carriers, at the expense of small Part 121 and Part 135 carriers. In addition, there exists up to 7 layers of management, and highly variable spans of control (8:1 to 16:1) within AIR and AFS. Finally, while approximately 20% of AVR's budget is spent on administration, there exists a duplication of functions such as supervision and policy interpretation, and there is limited coordination of many specialist programs with national policy development.

- Communications within AVR today is inefficient, as demonstrated by process-driven decision making through complex chain(s) of command, ad hoc liaisons or interfaces among informal groups across all AVR operations, and regionally driven policy interpretation. Outside AVR, industry has multiple, sometimes ad hoc or "convenience" interfaces that are inefficient and encourage practices such as "region shopping."

- Inadequate mechanisms exist to capture the intellectual capital (e.g. a lack of "organizational memory") needed to evolve in capability along with industry. For example, integrated product teams comprising AIR and AFS personnel, once disbanded after a major certification program, disperse most expertise and critical experience. There also is a limited career track for aviation safety professionals — promotion at AVR is rarely possible unless through the management chain.

- Workforce skills are strong in some areas, inadequate in others. For example, AIR has a good workforce mix of inspectors and engineers, but AFS is less well equipped to deal with its future challenges, with weak scientific/engineering capabilities in an increasingly sophisticated environment. Hiring policies presently reinforce the status quo (although HR reform may resolve this). Finally, the number of aviation safety regulatory experts and NRSs may be at less than 5 percent of required levels, a figure insufficient given strong safety arguments to date.

- Information technology, a critical resource for organizational effectiveness, is inefficiently utilized. Inadequate automation of routine work and data collection (with some exceptions) can be found in the workplace. Central to this is the issue of how to integrate information technology planning with organizational strategy, and ultimately to measure the impact of information technology on operational performance.

- In the international area — of great import to the future of AVR's activities — too little is invested in such activities as foreign certification and surveillance of air operators or CAAs. AVR's stated focus on its national mission results in unfocused international activities, and thus may lead to greater safety "gaps" moving forward.

These are a few of the findings of our work on the Challenge 2000 Project, and in the next section of this report, we present a framework for AVR which will equip it with the mission, structure and processes needed to enter the next century fully prepared to lead industry toward “zero accidents.”

4 RECOMMENDATIONS AND IMPLEMENTATION PLAN

Booz·Allen & Hamilton has analyzed the future aviation safety regulatory environment and, working closely with the FAA's Challenge 2000 Senior Executive Panel, with the Office of Regulation and Certification, and with the Administrator, has developed a change program designed to reposition AVR. These recommendations call for sweeping changes in AVR's regulatory philosophy and approach, its organization, the deployment of its resources, and its mix of skills.

Much of the work of the Challenge 2000 Project lies ahead. Implementation will require creativity, ingenuity, courage, and the power to persuade and motivate all who are touched by the coming changes — both internal and external to AVR. In addition, implementation will require demonstrated capabilities in a broad range of technical and business disciplines which are associated with the renewal of such an influential organization.

4-1 Recommended Future Model for AVR

Challenge 2000 is intended to reposition AVR for anticipated changes in the environment it regulates. But this must be done within expected resources, with the intended consequence of improving upon aviation safety nationally, and internationally. Stated briefly:

- Technological change in the aviation industry will present new human, structural, and resource challenges for AVR;
- Globalization of air transportation will require that AVR reconcile its current national mission and charter with its growing international responsibilities, brought about by:
  - — Globalization of the aircraft, propulsion and avionics manufacturing industries
  - — Airline consolidations and global alliances
  - — Different patterns of future growth in global aviation traffic;
- Given the present condition of AVR's safety regulations, its present mix and deployment of skills, its philosophy of regulation and its existing practices, the coming changes in the global safety regulatory environment will soon outstrip the capabilities of AVR's regulatory processes; and
- Change is occurring and will continue at a rapid pace while Federal government resources are being constrained by a need to reduce deficit spending, and for government to "do more with less."

Through this, the Challenge 2000 recommendations are designed to realize and support the goal of "zero accidents", accepted as a collective responsibility of Government and the aviation community. Thus the

recommended change program is sweeping, and is designed to strategically redefine and reposition AVR and the industry it oversees, and consists of four major elements:

1. **Shift roles and responsibilities of AVR and industry.** AVR recognizes that some of the air carrier and manufacturing organizations it oversees presently exceed "minimum standards" as defined in the FARs, and through proven safety records, are capable of a greater degree of self-regulation. Only by giving these organizations more freedom to regulate themselves will AVR be able to shift its resources to those less capable organizations that require more intensive oversight and direction. Consistent with this observation, the Challenge 2000 Project recommends a reallocation of the roles and responsibilities between AVR and certain parts of the industry it regulates. Utilizing the "Centers of Excellence" concept, referred to below, AVR will move to program level definition, design and insertion of industry safety programs.

2. **Deploy functional resources through centers of excellence.** AVR's current mix and deployment of skills reflects the needs of the aviation industry as it existed when AVR was formed. The technologies that were changing most rapidly then, such as structures and materials, are relatively stable today. They have been overtaken by computer hardware and information technologies to include state-of-the-art multi-national satellite-based CNS/ATM systems, as the rapidly changing technologies of today. The Challenge 2000 Project recommends a broad overhaul of the structure and technological capabilities that reside in AVR through the adoption of a "Centers of Excellence" concept as AVR's new delivery mechanism. These CoEs would span airworthiness certification, flight standards, and other functional areas.

3. **Empower rulemaking and evolve to performance-based regulations.** AVR has authored much of the aviation regulatory system that exists today. Regulations have slowly but relentlessly evolved, becoming antiquated, complex, and vulnerable to multiple interpretations. The current system of FARs, and procedural handbooks is inflexible and inefficient. The rulemaking process takes too long and discourages widespread industry involvement. The Challenge 2000 Project recommends that these problems be addressed by redesigning the rulemaking process, employing the focused capabilities of the new Centers of Excellence, and by moving to performance-based regulations.

4. **Resize and restructure AVR for the new mission and operating model.** The change in roles and the needed delivery mechanism of AVR require a general reengineering of the organization and its processes. This reengineering will also allow AVR to apply better processes throughout the organization, and to utilize information and automation technology to increase efficiency. The Challenge 2000 Project recommends that a comprehensive process reengineering program be implemented, and that regulations governing former processes be reviewed with the end of moving to performance-based regulations.

Each element has with it attendant safety improvements and workforce efficiency benefits. The core elements of the change program, their key underlying concepts and justifications are described below.

4-1.1 Shift Roles and Responsibilities of AVR and Industry

Aviation industry participants have clearly demonstrated different levels of process sophistication in the design, manufacture, operation and maintenance of aircraft and of component systems. Linked to this is also the fact that some of these are already performing well above minimum safety standards. Some have demonstrated that they are more capable in developing and applying safety programs, and may be treated differently from other, less capable performers. AVR needs to find a way to leverage the demonstrated capability of top industry performers in safety program development.

Thus AVR should, in partnership with industry, begin to take an active role in defining, designing and developing major programs which will enhance airline safety. This effort may draw upon the "best practices" of the larger more capable players in the industry, which are likely to already have these kinds of programs in place (Figure 4- 1). Program level involvement moves AVR's contribution to industry to a new, more efficient level; responsibility for ongoing oversight shifts further to industry, while contribution to program development shifts further towards AVR.

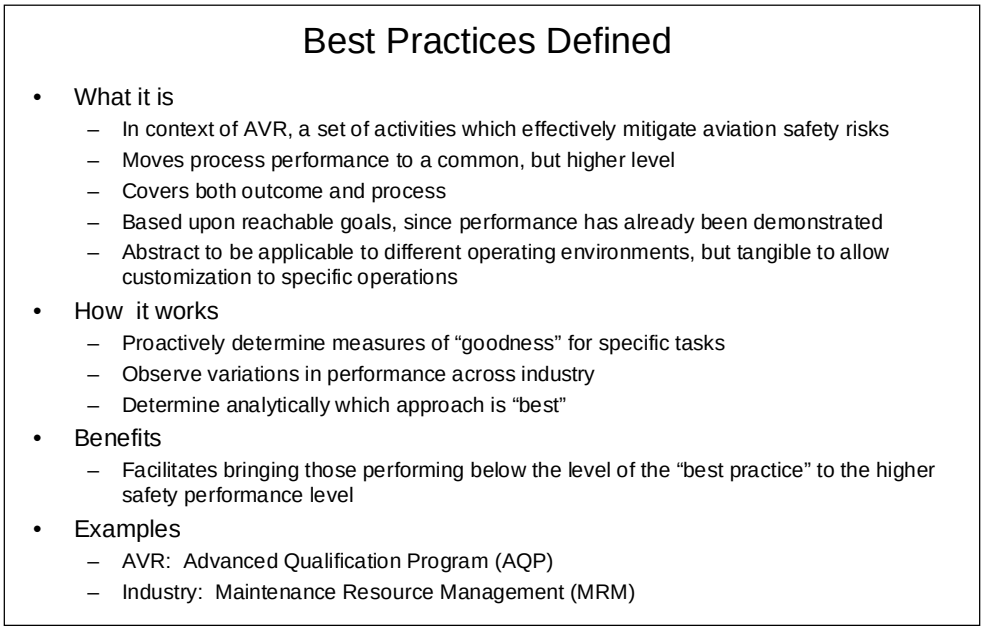


FIGURE 4-1 DEFINITION OF BEST PRACTICES

Recommendation 1: Build a "program level" capability to define the most effective aviation safety programs in manufacturing, operations, maintenance, etc., and at this new program level, work with less capable industry performers to assist in their implementation

Key Element 1: Convene individual AVR/industry panels to design key elements of each program and to utilize industry "best practices"

Key Element 2: The panel will define and oversee the initial activities for the program

— AVR role: establish criteria for oversight in the new program management environment; and

— AVR and industry together: research, definition, development, promotion, and assistance in implementing best practices.

FAA oversight will shift over time from the highest capability, best program generators to focus on poorer performers. Dealing with superior performers differently will result in a fundamental shift in the roles and responsibilities between AVR and industry. While AVR will move from detailed oversight of industry operations to more program level development and performance analysis of these performers, industry will take over more financial and program responsibility for executional surveillance (e.g., internal audits).

It should be understood that such a move does not diminish AVR's fundamental role of regulator and policy maker. Rather, it simply leverages current industry performance, and addresses industry's desire for more self-regulation where it is deserved. It also addresses a basic concern of all government agencies — that of more effectively managing decreasing resources. By moving to program level development and oversight of superior performers, AVR can redeploy valuable resources and better fulfill its mission of promoting aviation safety, while affording industry more operational flexibility.

This Challenge 2000 recommendation is designed to realize and support the goal of zero accidents, accepted as a collective responsibility of Government and the aviation community. In fact, for safety improvements, program level involvement has been strongly supported by industry safety experts from the NTSB, the Flight Safety Foundation, and others.

Key Element 3: Use "best practice" program management team to stratify industry based on:

— specific areas of performance;

— objectively defined performance metrics;

— multiple tier stratification (performer categories); and

— monitoring of performance.

It is proposed that industry can be stratified based on its performance against best practices. This concept essentially recognizes industry capabilities, providing a framework against which AVR can allocate its aviation safety experts and its inspector work force. It will enable AVR to apply different levels of oversight at each layer of the

stratification, and better focus its resources on problems. This proposed element is similar to the system used by the Nuclear Regulatory Commission (NRC), which internally categorizes the community it oversees on the basis of performance, and uses the categorization to allocate and deploy its resources.

While such a program will be entirely voluntary, better players will gain the economic benefit of less oversight. The applied surveillance will be focused more on the safety program level than on the inspection level, which will be complemented by more checks performed internally by industry, and audits performed by AVR. Performing this stratification requires that AVR have the ability to define superior processes with associated metrics, and measure the safety gains associated with their implementation.

4-1.2 Deploy Functional Resources Through Centers of Excellence

Rapid developments in aviation technology, growing globalization of the airline and manufacturing industry and other increasingly complex issues, described in Chapter 3, all suggest that AVR needs to consider a different operating model. The "Center of Excellence" (CoE) concept (Figure 4-1) has been successfully tested in industry with powerful results, and is recommended by the Challenge 2000 Project as the most appropriate future delivery mechanism for AVR. Under this structure, CoEs would aggregate technical resources into repositories of expertise to focus and enhance the capabilities required for the extraordinary complexities of aviation safety regulation.

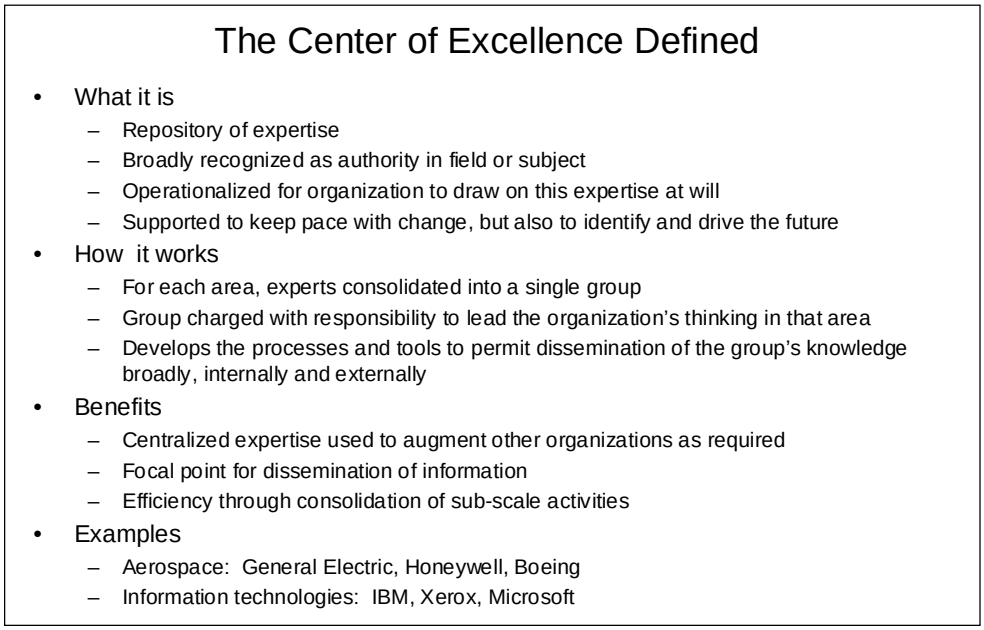


FIGURE 4-2 DEFINITION OF CENTERS OF EXCELLENCE

AVR would use the core staff of the CoE to consolidate policy making and interpretation, to develop safety programs, and to deliver AVR's products and services with functional and product specific focus. The CoE is also an appropriate mechanism to capture the intellectual capital needed to evolve AVR's capability along with industry.

Recommendation 2: Construct Centers of Excellence (CoEs) within AVR to develop and deliver AVR's products and services. Some 10 to 15 such CoEs will be required

Key Element 1: Establish a design team to define the CoEs, their roles and responsibilities, including NRS expertise, staffing requirements, and professional development needs;

Key Element 2: Of special significance, create a world class "information technology" CoE centered on aviation; and

Key Element 3: Establish a core team in each CoE having a comprehensive understanding of best practice program design and implementation.

A preliminary list of these functional areas might include air carrier operations, maintenance, propulsion systems or international regulation. For instance, one proposed center would specifically deal with information technology, an area key to the evolution of the aviation industry. In general, the CoEs will enable AVR to serve the entire regulated industry by functioning as a centralized "clearing house" for information. This will also shift the former regional focus of the organization to a more centralized one, allowing AVR to create focal points for interface with national and international industry and government bodies. This will position AVR for a leadership role with industry, where industry will accept the authority of AVR based on the excellence of its technical capabilities, and not only on the fact that it controls access to the aviation system.

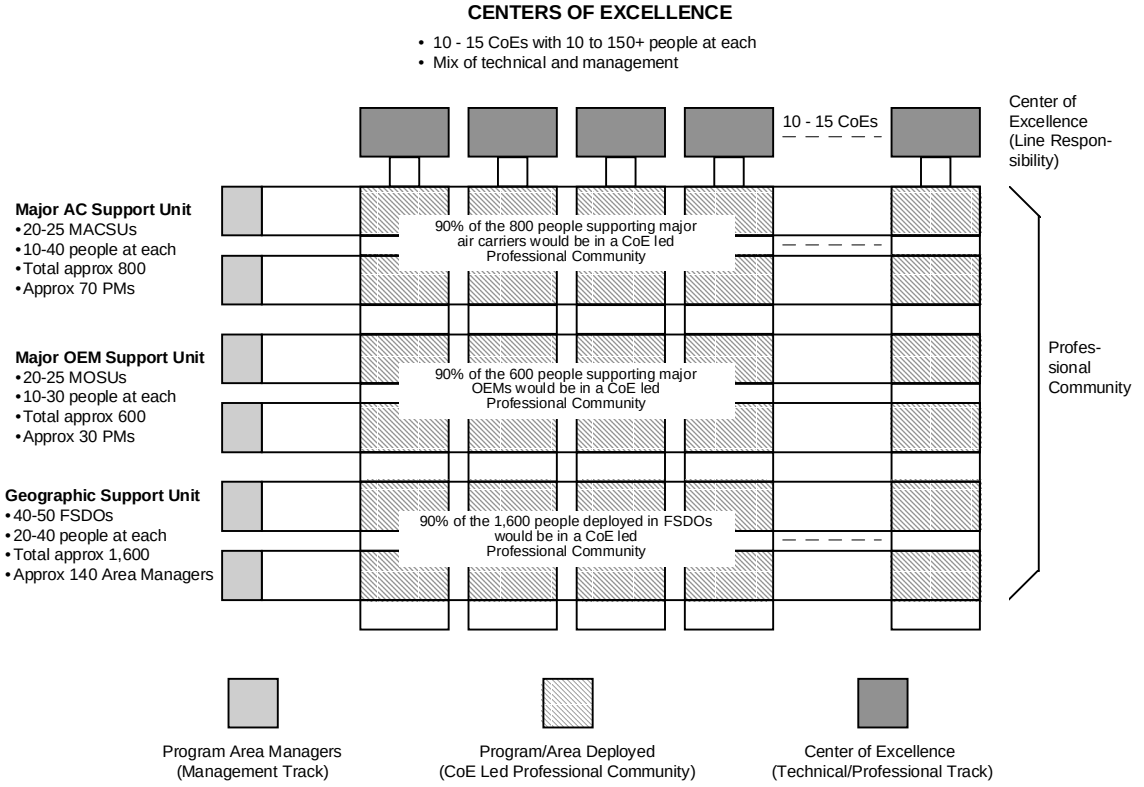


FIGURE 4-3 CONCEPT OF CENTERS OF EXCELLENCE FOR AVR

Recommendation 3: Shift from the current region-based organization to one based on CoE membership for line functions (Figure 4-3)

Key Element 1: Consolidate line activities of AVR into the CoEs and determine reporting structure for the CoEs;

Key Element 2: Reorganize specified field offices into major air carrier, OEM and geographic support units, who will then draw upon the professional communities of each CoE for staff; and

Key Element 3: Establish close linkages with other FAA organizations primarily through the core CoE organizations .

The CoE builds and maintains AVR capabilities, especially technical. Most inspection and engineering resources (some 90 percent) would be deployed in the field, but would report both to their CoE and the appropriate field organization — some (approximately 10 percent) are centrally located to provide technical support and training to field resources and to define best practices.

To deploy the professional community effectively against industry oversight responsibilities, a second type of organization is needed, and is referred to as a Customer Support Unit. This deploys AVR capabilities against "customers" in accordance with standards, policies and procedures defined by the appropriate CoE. There are three kinds of CSU organizations envisaged: (1) major air carriers, (2) major OEMs, and (3) geographic FSDOs supporting all others. Most resources (approximately 90 percent) also report to a CoE as well as their field organization — some resources (about 10 percent) are program or geographic managers or supervisors.

In order to function effectively in the future aviation environment, upgrading of the workforce's capabilities is going to be vital. Implementing the CoEs will allow the further development of a professional community to promote career opportunities and professionalism within the entire workforce, with a separate promotion track.

Recommendation 4: Utilize personnel reform to upgrade the workforce, beginning with the small specialized core in each center of excellence, and flowing down through newly established professional communities

Key Element 1: Define new requirements for the workforce, and specifically, recruit as many as 300 to 400 aviation operations and safety experts at National Resource Specialist levels;

Key Element 2: Assign personnel to "professional communities" as defined by each CoE. Characterize standards for professional performance and advancement within these professional communities that mirror and keep pace with evolving capabilities and skills of industry; and

Key Element 3: Use present attrition rates to acquire the new resources at enhanced education or skill levels.

AVR will need to address a host of regulatory and certification issues in order to foster and enhance its reputation as an international aviation safety leader. It will be able to exert global influence most effectively by "leading by example," as it designs and promulgates safety programs in partnership with industry. Such a change in operating strategy will serve as a model that international aviation authorities may then strive to emulate.

Recommendation 5: Define a specific role for AVR global leadership, beyond that of today

Key Element 1: Establish an International CoE.

Key Element 2: Develop a plan to enhance AVR's reputation globally in safety leadership, with possible elements to include:

— Globalization of the aircraft, propulsion and avionics manufacturing industries;

— in conjunction with ICAO, establish a regional regulation/oversight regime;

— develop programs to encourage U.S. industry to export products and services based on the highest levels of safety;

— sponsor and support R&D activities in the CoEs that will make a difference internationally; and

— define more comprehensive international safety leadership programs, building on BASAs, IASA.

As stated in Chapter 3, the future aviation environment will require new workforce skills and capabilities. To successfully implement this recommendation, AVR will need to further develop competencies in areas of risk management, such as, for example, cross system root-cause analysis, to determine linkages between performance and contributions to system safety. Several initiatives are already underway for these types of analyses (including SPAS, CAAM and others). With the CoEs in place, AVR will then have the framework it needs to approach the problem from a top down and systematic perspective, one that can incorporate ongoing initiatives.

4-1.3 Empower Rulemaking And Evolve To Performance Based Regulations

The current rulemaking process and the prescriptive nature of most of the FARs are neither responsive to the pace of change in the aviation environment, nor to granting industry the operational flexibility implied in the stratification program discussed above. This element of the change program requires three actions:

- Provide rulemaking with greater visibility and top-level attention;
- Move from a sequential process to one consistent with an integrated team; and
- Evolve towards performance-based regulations.

The first two actions are designed to address two major areas of concern regarding rulemaking at the FAA. First, there is consensus — among industry as well as within the FAA — that rulemaking is not given the high level management commitment it deserves, and that it suffers due to a lack of clear accountability. Second, the current process, with its average cycle time — to initiate, draft, and promulgate a rule — is almost four years. This can severely inhibit the pace of change in the regulated industry, since new technologies (for example, avionics software) may enter the market and even become obsolete in half this time.

If rulemaking is to become more responsive to public and industry needs, it is imperative that its principal participants — the Office of Rulemaking (ARM), technical program offices, and industry through the Aviation Rulemaking Advisory Committee (ARAC) — be provided with the authority, resources and skill sets necessary for the timely execution of rulemaking projects. This may be achieved by using a concept proven within industry as well as within the FAA — that of Integrated Product Teams (IPTs). It is worth noting that this concept has been used successfully within AVR in the very recent past — to develop and publish the "Commuter Rule."

Recommendation 6: Redesign the rulemaking process using integrated teams comprising all rulemaking participants

Key Element 1: Redesign process, moving from a sequential approach to a series of integrated teams responsible for each rule, with the CoE's being the major contributors to each;

Key Element 2: Set up integrated teams for each rulemaking project in close cooperation with ARAC Working Groups consisting of technical experts (CoE's), economists, attorneys, and others as needed. Limit sequential external review to the extent possible, and move OMB review to the integrated team;

Key Element 3: Empower rulemaking teams to set their own schedules and deadlines, and then make them dedicated to ARM for the duration of each project; and

Key Element 4: Give ARAC more "fast track" influence to encourage greater industry involvement.

An integrated team should be established for each rulemaking project. A team would have all requisite skills available within it, and would coordinate closely with industry (via the ARAC) to minimize delays. For example, a team might be comprised of technical experts from the relevant CoE, economists from API, attorneys from AGC, and administrative/policy personnel from ARM. Each team would be tasked and managed by ARM. More

significantly, team members would also be dedicated to ARM for the duration of each project. In order to improve communication between technical and non-technical staff, to eliminate time consuming multiple reviews and to resolve conflicts early on, both DOT review staff and legal staff need to be brought into the rulemaking team at the outset.

In addition, industry participation needs to be made more effective. Although industry does have a vehicle to exert influence on rulemaking via the ARAC process, its success has been limited at best. ARAC may be made much more efficient and cost effective by giving its Working Groups more "fast track" authority, by allowing them to set their own deadlines and holding them accountable to their schedules through incentives (to be determined). Instituting these changes is essential in order to ensure industry "buy in" from the outset and will result in more timely completion of assigned tasks.

Finally, internal processes must be redesigned. A systematic review of the rulemaking process will identify areas for improvement to reduce the total rulemaking cycle time. A preliminary analysis showed that by using integrated teams and the other steps described above, it may be possible to eliminate the requirement for a mandatory "quorum" of senior management in order to proceed to the next stage in the process to explicitly define signature authority to include responsibility for timely review completion; to allow simultaneous task executions, and to limit external (OST/OMB) review to the extent possible. These process redesign steps, combined with the previous steps, will go a long way in reducing the total rulemaking cycle time to 20-24 months. This is considered a feasible time frame for "reasonably complex rules" by both FAA and industry.

Evolving to performance-based regulations wherever appropriate is necessary since industry would ideally like to move towards a regulatory framework that is less "directive" in nature and instead focuses on performance — that is, regulations that stress the achievement of objectives rather than how those may be achieved. Performance-based regulations are formulated based on "what a desired outcome should be, " and not "how to do it."

Recommendation 7: Building on the minimum standards found in the existing regulations, evolve the regulatory system to a more performance-based approach to regulation.

Key Element 1: Within each CoE, establish an internal regulatory reform team with comprehensive understanding of industry regulatory design and application to:

— establish program structure and manage resources;

— examine performance-based regulatory practices found in foreign CAAs and in alternative industries to determine candidate best approaches;

— in a logical sequence tied to reengineering of AVR's processes (Section 4-1.4), review FARs and identify new architecture for evolving the regulations, one that simplifies rules, eliminates ambiguities, streamlines oversight procedures and accelerates harmonization with foreign CAA regulations; and

— establish program mechanisms for selective review of FARs, including streamlined ARAC committee processes needed to involve industry.

Key Element 2: Beginning with criteria that emerge from the industry stratification process, define new minimum performance-based standards that:

— are measurable;

— are capable of being uniformly instituted, controlled, and monitored;

— capture "best practices" whenever possible; and

— balance mandatory elements (including all minimums) with voluntary elements designed to give industry incentives to strive toward higher levels of performance.

Key Element 3: Evolve to new system of performance-based standards with CoE as policy interpretation focal point.

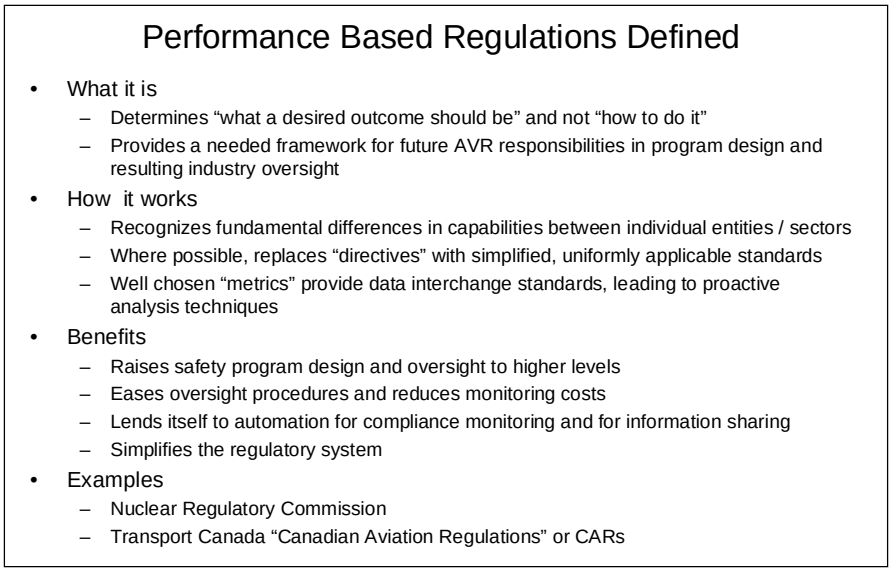


FIGURE 4-4 DEFINITION OF PERFORMANCE BASED REGULATIONS

This move to performance-based regulations is also consistent with the other elements of the change program, which will allow industry to have much more flexibility in operating in the future while maintaining or increasing accountability. It will also enable AVR to capture "best practices" and standards for their measurement; will provide an opportunity to simplify existing rules and methods of compliance; and will allow CoEs to be used as central policy interpreters. It should be noted that while the current body of regulations is essentially "directives" based, it does have some regulations that may be considered performance-based. Therefore, it would be necessary to identify and prioritize those regulations that can be simplified through a joint FAA/industry effort. In the interim, it

may be possible to allow the use of "Equivalencies" within AFS (similar to those used by AIR) as a temporary "bridge" in the move towards performance-based rules.

4-1.4 Resize and Restructure AVR for the New Mission and Operating Model

The change in roles and the needed delivery mechanism of AVR require a general reengineering of the organization and its processes. This reengineering will also allow AVR to apply best practices throughout the organization and utilize information and automation technology to increase efficiency. It begins with the structure.

The first aspect of this change element is the simplification of the organization complementary to the introduction of CoEs. Simplifying AVR in this manner will yield several benefits: reduced management layers, improved spans of control, consolidation of sub-scale activities in the field, and reduced duplication of effort (e.g., policy interpretation will be the responsibility of the appropriate CoE only).

Recommendation 8: Simplify the organizational structure by reducing management layers, and improve spans of control while empowering the work force at the lowest possible level

Key Element 1: Centralize staff and technical functions, and place work force into "professional communities" under the direct responsibility of each CoE;

Key Element 2: Move from a regionally driven framework to a regionally based, but centrally managed organization;

Key Element 3: Maintain focused certificate management units that will each report to a centralized Large Air Carrier manager and to an OEM Support manager;

Key Element 4: Focus remaining FSDOs and IFOs on geographic surveillance and other certification, including general aviation; and

Key Element 5: Optimize the spans of control for this centrally controlled, geographic deployment.

Recommendation 9: Consolidate sub-scale activities and eliminate duplication of effort

Key Element 1: Centralize the functions of administration, policy development and interpretation by evolving policy setting and interpretation to the CoEs; and

Key Element 2: Perform a detailed centralized environmental assessment, and design new resource decision support tools to include SPAS, EIS, etc.

The optimized organization and activities will then be more effectively cross-linked with other FAA activities to cope with the increasingly integrated demands for safety regulation (e.g., ATC-aircraft system integration).

Recommendation 10: Integrate AVR with other FAA-wide safety functions

Key Element 1: Create direct interfaces through the CoEs to control and support safety and regulatory initiatives occurring in other FAA organizations.

In addition to a reorganization, a streamlining of the major AVR processes will be necessary to reflect the changes and improve efficiency (e.g., inspection, certification, etc.). This will begin with a measurement of current processes, definition of improvement targets, blueprinting and testing of redesigned processes. New processes that are implemented will be continuously monitored and refined to make them as efficient as possible.

Recommendation 11: Streamline processes and develop a new-process-based plan for the careful deployment of information technologies as workforce automation and decision support tools

Key Element 1: Establish process reengineering teams for selected high priority areas;

Key Element 2: Select key inspection and surveillance processes which at all times maintain or increase inspector availability for field surveillance and counsel;

Key Element 3: Define process improvement targets for these, and develop new process blueprints;

Key Element 4: Implement process reengineering, to include work force skills assessments in line with new CoE focus on best practices, and deployment of information technologies as workforce automation and decision support tools; and

Key Element 5: With the integrated rulemaking personnel teams, determine the extent to which relevant regulations should be revised to make them more "performance-based."

As mentioned above, many of AVR's current bottom-up initiatives already address many of the environmental issues identified in Section 3 of this report. By contrast, all the elements of the change program are long-term in nature, and will have an impact on both AVR and industry well into the foreseeable future. This means that while the effects of the change program may not be immediately apparent, it must be initiated as soon as possible in order to effectively position AVR for the future.

4-2 Challenge 2000 Program Costs

A budget analysis was performed to assess the affordability of the Challenge 2000 recommendations, over the program period for FY1996-2002. AVR budgetary needs were assumed to be fulfilled through FY97, and no

additional revenues from user fees were considered. All significant costs associated with implementing the change program (in accordance with the implementation plan below) were estimated using AVR-supplied fiscal and personnel data. Finally, an analysis was performed to determine if these costs could be offset through a combination of increased delegation to industry and a gradual shift of AVR's responsibilities from surveillance to program level management.

The principal one-time costs include those associated with the establishment of CoEs; hiring of several hundred National Resource Specialists (NRSs) for these CoEs; information technology modernization; and additional funding for key programs such as SPAS. There will also be additional training required to upgrade AVR's current workforce skills and to meet existing shortfalls in training/pilot proficiency needs; process reengineering expenses; increasing foreign certification and surveillance activities, and costs to disseminate best practice programs developed by the CoEs.

However, it is possible to recover these costs by executing a basic tenet of the change program — reduction in the annual surveillance of top industry performers while maintaining the amount of oversight on marginal performers. Given that this requires a significant change in operating philosophy, this reduction is assumed to start only in FY98, by which time most major elements of the change program should be in place. Although total headcounts must necessarily decrease under the flat budget scenario (since salaries continue to rise), AVR's natural 6% workforce attrition rate, in conjunction with ongoing personnel reform initiatives, will allow AVR to bring in sufficient NRSs as well as more skilled technical personnel within existing budgets.

Under a flat budget scenario (no increase in real 1995 dollars beyond the FY1997 period), the analysis results indicate that it would be possible for AVR to complete the change program over a period of 3 years, with cost recovery dependent on the rate and magnitude of reductions in surveillance. Under a declining budget scenario of some 20 percent overall, the completion of the change program is likely to be delayed by 2 or more years.

4-3 Implementation Plan

The following section briefly describes the plan that is envisaged to implement the recommendations of the Challenge 2000 program. A suitable organizational structure, implementation phases, tentative schedule and milestones are suggested and discussed.

4-3.1 Overview of Implementation Plan

Challenge 2000 is a major long term initiative that will affect all aspects of AVR's activities, and ultimately the industry it regulates. In order for it to be successful, it must be closely linked to the pace of change required by the regulated industry. However, at no time will the critical oversight needed to ensure safety of the aviation system be sacrificed. When all necessary elements of the Challenge 2000 program are fully implemented oversight will be expected to increase dramatically.

Thus the implementation plan described below is designed to maintain AVR's current inspection and surveillance activities at all times. The plan requires the following elements to ensure success:

- Strong, consistent leadership from the Administrator;
- Evolutionary, as opposed to radical, changes in regulatory and work force processes;
- Prioritization of program elements;
- Strict ongoing control of each implementation stage to maintain momentum;
- Clearly defined milestones with visible and tangible results; and
- The use of established and proven best practices in place of existing processes.

The success of the program itself needs to be measured against the identified benefits of the different change elements realized by FAA as well as by industry. During the course of the change program, industry will gradually assume more responsibility, and its progress must be monitored in the same way as AVR's progress is monitored.

For the implementation of a change program in AVR's complex environment, the utilization of demonstrator, or "pilot," programs is highly recommended. Such programs may be implemented, for example, in one region (or FSDO) only, or for a specific reengineered process. The advantage of such an approach is that AVR can obtain quick results in the real world environment, and can refine the implementation process itself by using the lessons learned in the limited application. Furthermore, the success of such pilot programs will enable AVR to build valuable skills and reengineering experience, will maintain the momentum of the change program internally, and will enhance external credibility and support.

Crucial to *Challenge 2000*'s success will be effective communication of the change program in order to gain internal and external support and cooperation. The initial outreach program needs to include reasons, goals and the elements of the change program. Industry and public feedback should be solicited and incorporated in the detailed design of the changes. As the implementation plan progresses, the achieved results need to be made known to gain continuing support. This communication effort is an ongoing task with focus on the initial phase and regular updates, especially after achieving major milestones.

4-3.2 Implementation Phases and Steps

The implementation of such a major change program is usually split into several phases. The change program suggested for AVR is unique due to the tight linkages and dependencies between the recommendations, making it difficult to separate the main implementation into different, self standing phases. To begin with, two stages have been identified for AVR's change program:

- Detailed design phase (approximately six months); and
- Implementation phase (individual milestones defined monthly).

During the Detailed Design phase, several activities will be initiated, their principal objective being to detail the planning which is necessary for such a large scale, complex, and highly cross-linked implementation plan. The steps during this phase include:

- Prioritization of implementation areas and selection of demonstrator programs;
- Selection of implementation teams and establishment of project organization;
- Integration of the current initiatives/projects and programs (e.g., SPAS, FRESH AIR);
- Analysis of detailed design and implementation costs;
- Detailed analysis of future organization and implied operations cost; and
- Analysis and resolution of legal and political prerequisites.

During the Implementation Phase, a separation into major steps with finished activities and a handover to the next step is not possible. However, major milestones should be declared and the accomplishment of results closely monitored. The majority of recommendations will be implemented in several steps, each of which are highly dependent on the results of previous (or concurrent) activities. A typical example is the following:

- Detailed analysis and assessment of current situation (costs, speed, performance);
- Definition of goals and blueprinting of future scenario(s);
- Pilot program implementation;
- Adoption of blue print by analyzing lessons learned;
- Full scale implementation;
- Measurement of program success; and
- Development of future refinements.

4-3.3 Implementation Structure

The change program needs to be driven by top management commitment. Therefore, the Administrator will play a vital role in the success of Challenge 2000. It is suggested that he be supported by the following project organization to facilitate the change program (see Figure 4-5):

- FAA Steering Committee: provides top level direction and support;
- Change Program Project Team (3-6 people): manages and controls implementation of task teams and projects;
- Task teams (8-10, each 4-7 people): empowered to manage specific subtasks (e.g., stratification of industry); and
- Advisory/Support teams (number to be decided on demand basis): provide implementation expertise and manpower, to enhance task teams or give advice on an ad hoc basis.

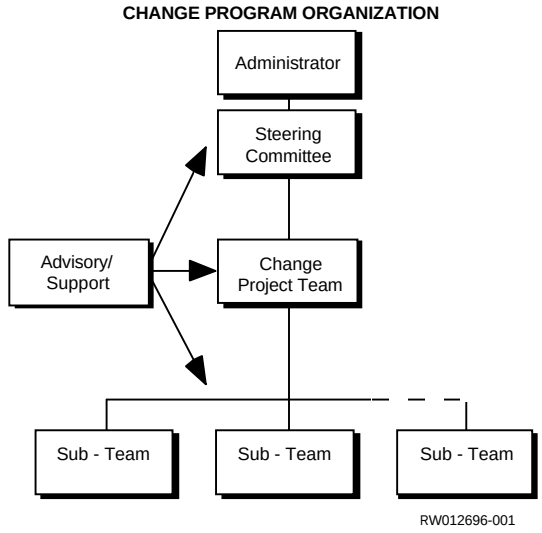


FIGURE 4-5 CHALLENGE 2000 CHANGE PROGRAM ORGANIZATION

The successful implementation requires a multidisciplinary set of capabilities within the implementation teams. Therefore, each team will typically consist of three types of participants:

- Managers with organizational expertise as well as broad customer and process knowledge;
- Functional experts with skills in project management and reengineering; and

- Technical experts with skills in specific areas (e.g., a Human Resources specialist for work force upgrade issues).

Functional experts and managers should be staffed from the relevant AVR offices, with the balance drawn from staff and line personnel. In addition, most teams should have external experts from industry to provide advice and consultation as needed.

Total commitment of the team members is one of the most crucial factors during implementation. The members of the Change Program Project Teams as well as the task teams need to be dedicated full time to this program between important milestones. Steering committee members should be committed at least up to 30 percent of their time. Preferably, a small number of external advisory/support professionals should be utilized on a full time basis.

Empowering the task teams is also fundamental to the success of the implementation plan. These teams should ultimately be led by candidate line managers who need to take ownership of the changes. In the initial phase they may be substituted by the above indicated managers, as long as they are authorized to make key relevant decisions.

Task teams should be established in various areas. Due to the intrinsic cross linkages of the various change elements, close coordination is essential. Proposed areas for task teams at the initiation of the implementation plan include:

- Best practice programs/stratification and resource allocation process;
- Centers of excellence/organization;
- Pilot implementation of a representative CoE and best practices (after lead time of other projects) prior to complete implementation;
- Work force capabilities upgrade (defining and establishment of process);
- Redesign rulemaking/performance-based regulations; and
- Reengineering internal processes (one team for each major process).

4-3.4 Schedule and Milestones

It appears that three to six years will be necessary for complete implementation and realization of the benefits of the change elements. However, the important groundwork will be laid during the first 12-24 months. All activities extending this time frame will depend on several factors, including: the pace of upgrading AVR's work force capabilities; available resources; additional non-recurring activities such as rewriting regulations, as well as

technological (and other) advances made by industry. The accompanying Gantt chart (Fig. 4-6) gives an overview of activities during the implementation period (see attachment for detailed Gantt chart).

It should be mentioned that these schedules — especially the Detailed Design Phase — can only be achieved if necessary resources are made available at the outset of the change program. It is possible to stretch the times and execute certain worksteps in sequence rather than in parallel if resources are limited. However, this is not recommended because project momentum and staff motivation may be lost as a result.

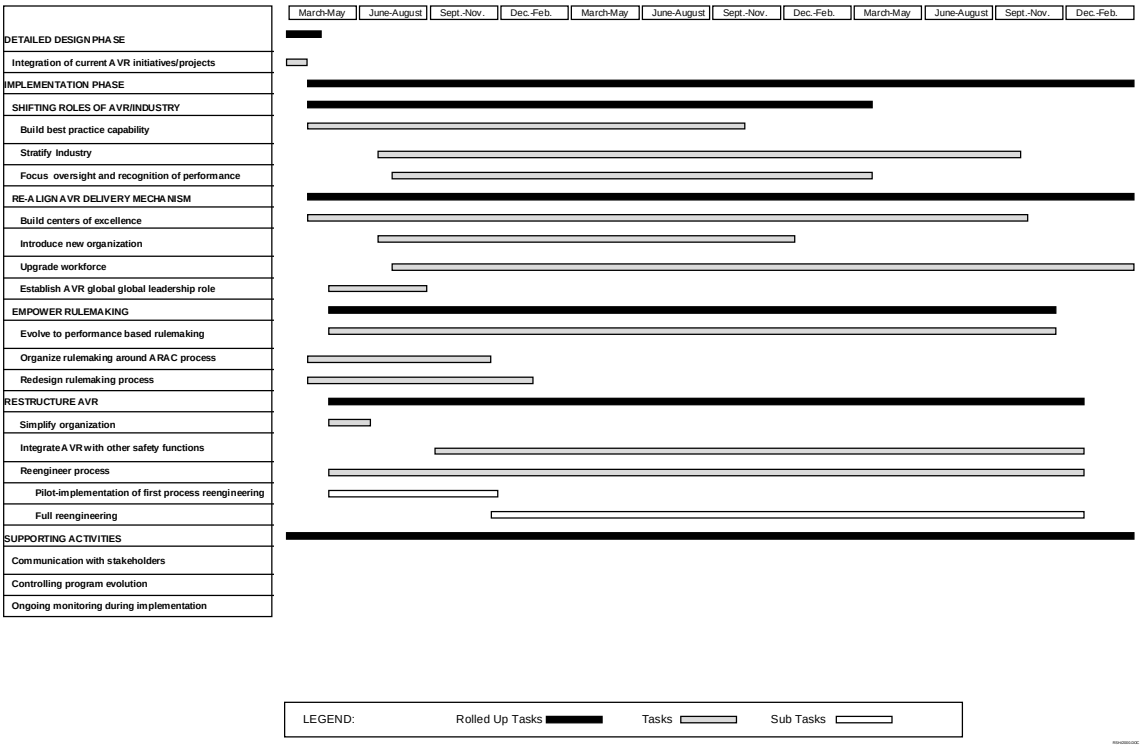


FIGURE 4-6 PROPOSED IMPLEMENTATION PLAN

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The *Challenge 2000* project required extensive research to understand all aspects of the aviation environment. Several hundred documents — including news reports; GAO reports; Inspector General reports; and AVR technical documents such as inspector handbooks and manuals — were used as part of this research. Critical safety data were obtained from the National Aviation Safety Data Analysis Center (NASDAC). Information was also obtained through discussions with the program participants (see Table 1-1), many of whom provided important background material to team members. A selection of key documents (in descending chronological order) used by the project team is listed below.

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